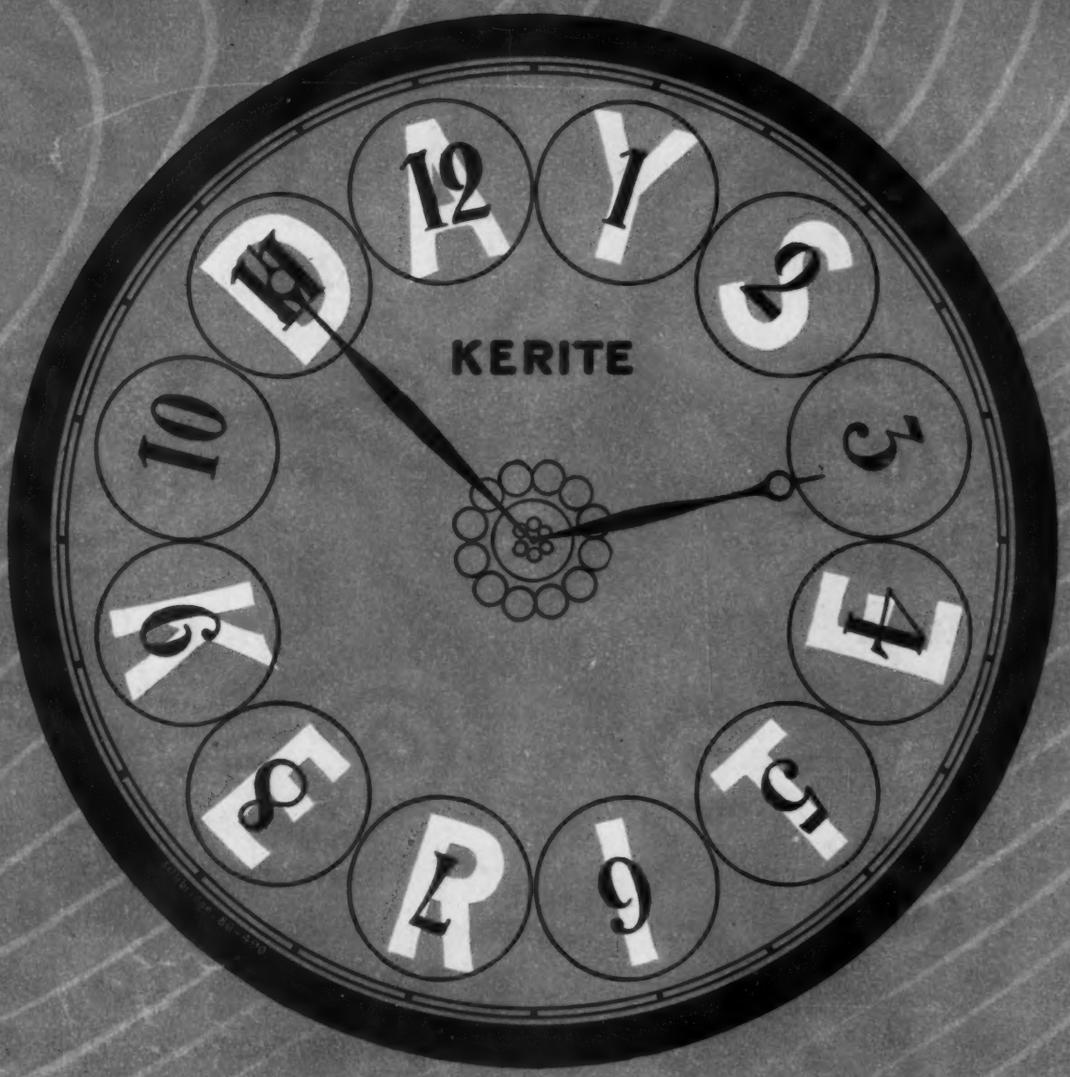
JUN 9 1921

Electrical World

McGraw-Hill Company, Inc. New York, June 4, 1921 Twenty-five Cents a Copy



Time is the great test. The most efficient and permanent insulation known is

KERITE

KERITE INSULATED WIRE & CABLE COMPANY

NEW YORK CHICAGO

WORLD'S ONLY MAKER

Moulded High Frequency High Tension Insulators

TRADE ELECTROSE MARK REG. U.S. PAT. OFF. & FOREIGN COUNTRIES. INSULATORS 1,000 TO 1,000,000 VOLTS

Medal and Diploma received at World's Columbian Exposition, Chicago, 1893

TRADE ELECTROSE MARK REG. U.S. PAT. OFF. & FOREIGN COUNTRIES.

INSULATION MADE IN AMERICA

Louis Steinberger's Patents

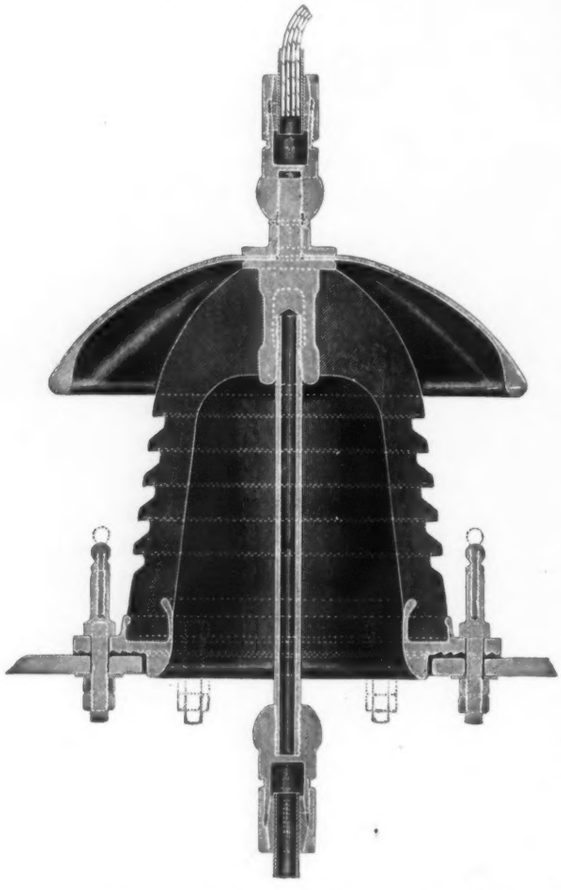
Medal and Diploma received at World's Fair, St. Louis, 1904

ARRIVED

ARRIVED

TRADE ELECTROSE MARK REG. U.S. PAT. OFF. & FOREIGN COUNTRIES.

AIR-GAP TYPE BUSHING No. 8350



TRADE ELECTROSE MARK REG. U.S. PAT. OFF. & FOREIGN COUNTRIES.

AIR-GAP TYPE BUSHING No. 8350

ALL STRESSES IN AIR

ALL STRESSES IN AIR

"ELECTROSE" Insulators are standard with UNITED STATES NAVY and ARMY and Wireless Telegraph and Telephone Companies.

"Electrose" is made in a number of grades for various requirements, each grade possessing special characteristics.
"Electrose" Insulators—Best in the World for High Frequency Currents, Power and Transmission Circuits.

"ELECTROSE" STANDARD PRODUCTS

"Arcover" Disk Strain and Suspension line Insulators, "Safety Strain" Insulators, Disk, Hood, Thimble and Rod type Strain Insulators, Spools and Bracket-Arm Strain Insulators, Pin type line Insulators, Insulator Pins, Roof, Barrier and Wall Bushings and Insulated Connectors, single and multi-part plain and locking, water and gas tight. Bus-Bar Insulators, Insulating Supports and Pedestals, Arc Lamp Insulators, Insulating Knobs and Handles, Insulating Sheets, Tubes and Rods, etc., etc.

"Electrose" Railway Line Material:—"Safety Strain Insulators, Brooklyn Strain Insulators, Insulated Turn-Buckles, Caps and Cones, "Ideal" Locking Caps and Cones, Insulated Bolts, Feed Wire Insulators, Third Rail Insulators, also special forms of Trolley Wire Suspension Insulators, etc., etc. Complete line always carried in stock.

Ignition Insulating Parts:—Distributor Blocks, Disks, Switch Bases, Spools, Brush Holders, Knobs, Handles, etc., etc.
"Electrose" insulation (certain grades) is recognized as the best obtainable for use in connection with insulating parts for ignition service for Automobiles, Aeroplanes, Motor Boats, etc.

Insulators and Insulating parts and devices of special sizes and forms, designed and made to order.

SOLE MANUFACTURERS

ELECTROSE MFG. CO.

60-82 Washington St. 27-37 York St.
66-76 Front St. 1-23 Flint St.

Brooklyn, N. Y., America

Electrical World

New York, Saturday, June 4, 1921

Washington Sends a Message of Encouragement

WE HAVE recently received a very heartening message from the government to American business. The President, the Vice-President and the Secretary of Commerce gathered with the leading business men of the country to commemorate the one hundred and twenty-fifth anniversary of our oldest and greatest business newspaper. They united in an earnest effort to interpret to the business men of the United States the business purposes of the administration. They outlined an attitude of reasonableness and helpfulness that if consistently maintained will bring the stimulus and strength to business that we need so greatly.

Now the electrical industry—in its many branches—is before all else a business. It is a business singularly vital to the commercial health and prosperity of the community and the nation. This message, therefore, has been spoken to us no less than to other groups of business men, and it has been addressed to us as individuals for the encouragement and guidance of the day's work.

In a word, the message is this: that honest business is to be helped and not restricted, that the bigness of business is not to react to its prejudice so long as it is fair, that the true function of the government is and will be to work for business in intimate practical co-operation. To this end the Department of Commerce is proceeding to develop a new, enlarged program of service to every branch of trade. And Secretary Hoover appeals to the business press of each separate trade to aid in defining and disseminating the service to its own industry.

This is good tidings. But the extent of the benefit it brings must depend upon the degree to which it is utilized. The amount of personal help that comes to any single man will be in the measure of the intelligence and zeal with which he seeks it and applies it in his work. That is the point that every man in the electrical business must keep in mind.

As the plans unfold, the ELECTRICAL WORLD will report and present to the electrical industry these new services which the government has promised. This will be in accordance with the plan of Mr. Hoover, who pointed out that the business paper is the medium within each trade for the prompt and useful distribution of this practical and profitable information and advice, which will come in steadily improving quality and quantity. Watch in the ELECTRICAL WORLD, therefore, for this new help *for you* from Washington.

Milan Raynard Bump

Who brings to the National Electric Light Association as president-elect a broad national point of view gained through engineering studies and executive supervision of properties in more than half of the states of this country

AN ENGINEER of broad experience with a sympathetic understanding and appreciation of all phases of the electric light and power business has been chosen to lead the National Electric Light Association during the coming administrative year. Milan R. Bump is the fourth member of Henry L. Doherty & Company to become president of the N. E. L. A. Since 1910, except for a few months six years ago when he was vice-president of the Picher Lead Company, Mr. Bump has been chief engineer of the Doherty organization in charge of all engineering and of the construction and operating departments of the public utility division. Later he became a member of the executive committee of the company in charge of the oil transportation, refining and marketing divisions and the natural-gas division.

Mr. Bump was born at Rock Falls, Wis., March 18, 1881. His boyhood was passed in Spokane, Wash., where he received his early education in the public schools. At the age of twenty-one he was graduated in electrical engineering from the University of Wisconsin. Immediately he entered upon engineering work with the Washington Water Power Company. A year later, however, saw him back at the university, where he was an instructor in electrical engineering for a year. In 1904 he became associated with Henry L. Doherty as the first cadet engineer of the Doherty training schools. Until 1906 he was engineer for the gas department of the Denver Gas & Electric Light Company. In the year just named he was selected as examining engineer for Henry L. Doherty & Company and sent to Joplin, Mo., the great lead and zinc district. There he remained until 1909, consolidating several utility properties to form the Empire District Electric Company, of which he became treasurer and general manager. He also designed and erected a large modern steam plant and an extensive transmission system covering that entire mining field. In 1910 he left Joplin for New York to take up his present duties. During his first five years as chief engineer of the Doherty organization Mr. Bump was engaged largely in examining for purchase and revamping many of the utility properties of the Cities Service Company subsidiaries.

In his work of rehabilitating sick utilities Mr. Bump has become a firm believer in the value of good public relations. It is not surprising therefore to find in him one of the most ardent advocates of customer ownership of public utility securities. He is a thorough student of public utility problems even though they be apart from engineering, and through his executive touch with properties in more than half the states he brings to the N. E. L. A. a well-balanced national point of view that should prove of immeasurable value to the electric light and power industry.

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician
Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR., Editor D. H. BRAYMER, Managing Editor
S. B. WILLIAMS, Assistant Managing Editor A. M. PERRY, Engineering Editor J. C. MARTIN, Western Editor G. E. ARMSTRONG, Pacific Coast Editor H. S. KNOWLTON, New England Editor
Associate Editors: P. S. BIEGLER C. T. BALDWIN R. H. BACON
T. P. KINDIG R. M. DAVIS E. H. HUBERT F. C. WELLS

Volume 77 New York, Saturday, June 4, 1921 *Number* 23

Government Reorganization and Bureaucratic Inertia

INERTIA, the greatest natural obstacle to human progress, whether individual or collective, grows with the growth of the body whose action it impedes, and where, as at Washington, the political concerns of a vast nation center, only constant vigilance and effort can resist its paralyzing effect. Government departments by the nature of their being become lazy and complacent, and when new blood is injected into executive veins the first effect on the bureaucratic system is not a reaction to the stimulus but an effort to smother the new blood with the old while performance goes on in the old, imperfect way. There is some fear that this may be the fate of the promising movement for governmental reorganization which, having its origin in a demand from all parts of the nation for greater efficiency and economy in government, was hailed by some super-optimists as all but accomplished when the new federal administration took hold. In reality, before this work can even be started, traditions must be exploded, opponents thwarted and Congress convinced. At the present rate of progress two years hence appears as the earliest date when new machinery will really turn. This is far too long a time to wait. If anything worth while is to be done while the country is in a reforming mood and before enthusiasm dies out, insistence and persistence must mark the daily mood of those whose duty it is to lead this movement—whether they be the engineers, eager to place at the service of their eminent confrère in the Department of Commerce proper instrumentalities with which to accomplish his great task, or the business press, to whose power President Harding recently paid so high a tribute, or the commercial world in general, so dominant a part of the nation's life and to whose ideals of honestly won success government co-operation intelligently directed can contribute so much.

Need of Qualified Counsel in Hearings Before Regulatory Commissions

THE law's delay of which Hamlet complained often prevails in an aggravated form in the rate hearings of public service commissions, but with this difference as compared with court procedure, that it is due not so much to red tape and obstructive legal tactics as to the incompetency of the opposing counsel. In too many cases these lawyers, however learned in the statutes they may be, know little of public utilities or of the principles that govern their valuation. They are neither rate experts nor valuation engineers, let alone electrical technicians. In many recorded cases they have frittered away the commission's time and added thousands of dollars to the cost of the proceedings because of their unfamiliarity with the specialized statistics and engineering that enter so largely into the arguments. There are many courts, and it is sometimes possible to expedite the progress of a cause by transferring it from one court to another; but there is in each state only one commission where a given rate case can be heard. Would it not be logical to require that those who desire to practice before regulatory bodies, where calendars are usually crowded, and where in many states executive funds are insufficient and trained staffs are too small, should pass an examination to establish their competency? If all the counsel were specialists in this specialized field, justice would be surer and the utilities and the public would both be served.

An Epoch-Making N. E. L. A. Convention

THE greatest number of electric light and power company executives ever yet assembled by the National Electric Light Association met in convention in Chicago this week. In depth, breadth and height the convention was a record one. The association has at last found its stride and in a single bound has leaped beyond the petty detail of routine to the larger and more vital questions of public relations and finance. Not that the engineering problems involved in the generation, transmission and distribution of electricity were neglected—the numerous and exhaustive reports of the association's excellent engineering committees disprove that—but that the dominant issues confronting the industry were brought out and accentuated in a way to command respect and rivet attention.

There can be no question that a satisfactory solution of these problems is imperative if the industry is to continue to go forward. Neither can there be any doubt as to the determination of the National Electric Light Association to knuckle down to the task. The utilities no longer fool themselves or the public as to their rights and privileges. The commissions, the courts and public opinion have taught them otherwise. What they now seek is a wider appreciation of the difficulties under which they, as regulated monopolies, operate and public good will in their solution. Not satisfied to trust entirely to their own best judgment as to the proper course to pursue, the counsel of public service commissioners, publicists, government officials, captains of industry and others has been sought, and the result has been astonishing. Whereas the utilities previously saw their opportunities for service as through a glass darkly, they now see them face to face. Thus a new spirit animates the National Electric Light Association. It is no longer the old association. Wideness of vision and bigness of purpose are now its chief characteristics, and these were revealed at the convention this week. The enlarged program has met with the hearty approval and support of the manufacturers, and now that the

supply jobbers are to have a seat at the council table, who can tell how great progress is in store? All branches have caught the spirit and are inclined to help the public utilities win financial and popular support. It remains but to put some co-operative plan into action whereby manufacturers, jobbers, contractors, central-station companies, investment bankers, chambers of commerce and other bodies will join in an effort to that end.

If the enthusiasm just inspired at Chicago can be maintained—and there is no reason why it cannot be even increased—the financial thirst of the industry can be largely assuaged. The will to serve has been established.

Ratings of Pin-Type Insulators

IT HAS been known for a long time that the present method of rating pin-type insulators has grown up in a haphazard way, probably being largely influenced by the common practice of calling for other equipment on the basis of the nominal rating of the circuits on which it is to be used. This practice is necessary with generating and transforming equipment, where adequacy of design is a factor that must be worked out by the factory designer. Its application to insulator practice has only resulted in confusion, because the factory designer necessarily is precluded from knowing the conditions under which insulators of any given rating may be used. System load and capacity, length of lines, the presence or absence of climatic conditions or lightning disturbances, the presence of salt, excessive amounts of dirt or chemicals in the atmosphere and other conditions play an important part in the rating of insulators which are to be used in any particular case.

The impracticability of considering all these conditions in assigning a normal line voltage rating for catalog purposes has led to a great amount of confusion in the selection of pin-type insulators, with results that have in many cases permitted serious and expensive line interruptions. With only flashover voltages listed, it would seem possible to suggest limits for factors of safety covering given conditions which could be tabulated in much the same way that data on factor of safety are tabulated in the literature dealing with structural materials. Such a method should at least avoid misleading results and, if properly carried out, might lead to a more careful thinking out of line insulator problems than has usually been the case.

In this connection it is interesting to note that the elimination of the present method of rating pin-type insulators by nominal line voltages and the substitution of the wet and dry flashover voltages in catalogs as the only voltage rating are under consideration by a committee of the American Institute of Electrical Engineers. The National Electric Light Association through the overhead systems committee is co-operating in the study. It is to be hoped that the committee will receive a full expression of opinion from interested engineers and find a solution that will do away with the present confusion. It is, of course, assumed that if the proposed method of rating is adopted it will be accompanied by satisfactory test specifications which will make certain that all ratings for these insulators can be given on the same basis.

Rapid Progress in Hydraulic Power Developments

ONE learns to look for material of great technical value in the annual reports of the committees of the National Electric Light Association. This year a new committee comes to the front charged with reporting on matters connected with hydraulic power, and its conclusions form no exception to the rule we have just noted. Two points to which the committee gives special consideration are of particular interest and importance. First comes the matter to which we have more than once made reference, the very great improvement in the design of waterwheels during the past twenty years or so. Up to the time that the waterwheel began to be extensively used in hydro-electric plants it had undergone few changes for the better in several generations. In two particulars it was especially faulty—efficiency at moderate outputs and specific speed. Both these failings were probably due less to the incapacity of the designers than to lack of insistent demand, which is the only spur to renewed improvements in an old and somewhat standardized product. Until the period of rapid growth in electric power transmission waterwheels were generally used under conditions of fairly steady and fairly high load. When running at all they were running somewhere near designed full load, and since the transmission of power was generally by extensive systems of shafts and belts a relatively high speed of the wheel was not of great importance.

Within twenty years the maximum efficiency of good-sized waterwheels has been lifted by approximately 10 per cent, and the point of maximum efficiency has dropped back from full load to a point between half and three-quarters load. In recent wheels the efficiency curve has been particularly flat, staying above even 90 per cent from half load to full load. The origin of the improvement has been in the more careful design and finish of runners and their cases to avoid friction and eddying. Moreover, the speed of the wheels for given output has been very considerably increased again by design with special reference to this quality, so that direct coupling to generators is feasible under conditions that would have been regarded as quite impossible even ten years ago. Incidentally there has been steady effort to improve the draft tubes with respect to smoothness and facility in getting the water out of the way after passage through the wheels. A number of patented designs more or less similar in result have recently appeared, all of them tending to the same good end of stiffening the working head by facilitating the escape of water. The gain in the net efficiency of the wheels, including their settings, is not immaterial, and the results have been on the whole very gratifying.

Secondly, the report deals in some detail with the study of water supply from the standpoint of rainfall and run-off. There are comparatively few streams in which there has been long-continued and explicit study of flow relation to rainfall and the character of the drainage area. One has to go more or less upon general data, and in the report before us some rather interesting matter is given concerning such data for the Appalachian territory. It is shown, for example, graphically that the rainfall on the southeastern and western slopes varies very radically not only in absolute amount but in respect to the altitude of the territory concerned. On the southeastern slope the rainfall at high altitudes is double that on the western side, while at low altitudes

the figures are approximately equal. Once the data from various stations are put in shape, it becomes a fairly easy matter to estimate the probable available rainfall at any point. But these data vary greatly as one passes to another part of the country, so that generalizations can be made over only a limited area.

Still another feature of the report deals with the study of losses by evaporation, which limit the storage facilities as well as the flow itself. In the common case, where storage is fundamental to economy of operation, more thorough study of the evaporative losses becomes imperative, and we hope that the subject will be given steady attention by the new committee.

Operating Practice with Overhead Lines

AS USUAL, the report of the overhead systems committee to the National Electric Light Association is full of important matter. One can barely touch the high spots in editorial comment, for the report is both long and thorough, being particularly devoted to searching out the results of actual practice by carefully prepared questionnaires. Two of the long-mooted matters which come to the front are the practical properties of the delta-connected and star-connected circuits and the usefulness of ground wires in protecting them. As between delta and star connection there has been long dispute, each system having certain theoretical advantages, it being assumed in this connection that the star system is more or less thoroughly grounded. A questionnaire dealing with all phases of the matter was sent out, and an examination of the many replies seems to show that as a matter of actual practice the grounded star has "made good." Not a few companies which started operations with delta connection have more or less completely shifted over to the other construction. It is, of course, plain that a grounded system runs some chance of interference that is less probable on an ungrounded delta system, but, on the other hand, plant after plant has found that the surging conditions are greatly ameliorated by passing to the grounded star. Practice differs as to thoroughness of the grounding, a matter which seems to depend considerably on local conditions; but a return to star connection is unmistakable, as it has been indeed for some years past, and the report before us confirms the judgment which has been gradually forming.

Another matter in which the results are perhaps less readily foreseen is the question of protection of lines by grounded conductors strung over them. Little used in the very early years of power transmission, the practice has steadily spread, chiefly because of its real or supposed value as against lightning. The committee's questionnaire brought in a large amount of practical information, and while it is far from homogeneous, it leaves a strong impression of doubt concerning the value of overhead ground wires. The records seem to indicate that such wires afford a probable protection to insulators of unknown magnitude, an immaterial amount of protection to station apparatus, and an effect on general disturbances of the line, including lightning, which is of decidedly doubtful import. The summary certainly does not show the great protective value which was firmly believed in over a considerable period, and the whole question is left by the committee as one on which much further information needs to be obtained before deciding whether the practice is good, bad or indifferent.

One more phase of the committee's work deserves comment. In this case the results are of a very definite character, the subject being preservative treatment of wooden poles, which we have preached off and on for a long period past. The favorite treatment indicated is with some variety of creosote oil or an equivalent substance. Sometimes the whole pole is treated, more frequently the butt, since rotting usually takes place at the ground surface. Of late it has become a frequent practice to puncture the butt of the pole in many places to permit the more ready entrance of the oil under treatment. Very little accurate data are to be obtained as to the results of treatment by various plans, since it is almost impossible to find out just how thorough the work has been or just what the ground conditions are against which the pole has to contend. Broadly, however, the indications of more than a decade of experience are that the controlling factor is the thoroughness with which the preservative has penetrated the pole. If it has soaked in well, a very considerable increase in the life is generally found, a large proportion of the treated poles remaining perfectly sound after a dozen years' use. The treated poles which were found rotted showed lack of penetration. Seasoned poles obviously can be more thoroughly treated than unseasoned ones and give correspondingly better results. Coal tar and crude oil, sometimes used, seem to have proved relative failures, probably less on account of their actual properties than by reason of their failure thoroughly to penetrate the wood. At the present time, when poles are unpleasantly expensive, and getting scarcer at that, the moral is a clear and obvious one.

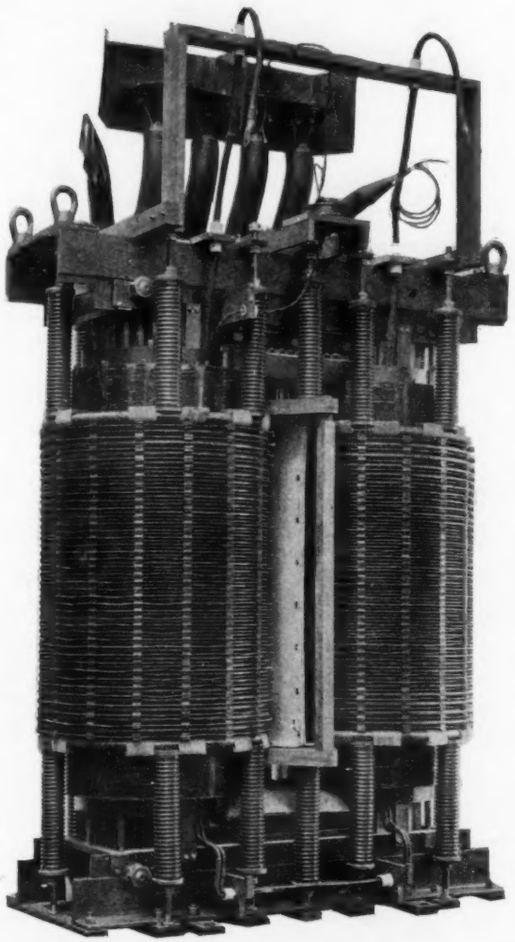
How Far Should Industrial-Plant Metering Be Carried?

JUST how far metering should be carried in the industrial plant is a problem which will bear careful investigation. It is one of those points where the electrical engineer, plant management and accounting department of an industry come together on a common ground—namely, the cost of the finished product. In most cases the probability has been that metering has not been carried to the point of being able to determine the department power or lighting costs, to say nothing of these costs per unit of product.

The charging of power costs to overhead expense may result in the selling of certain products at a loss, although the entire output of a plant may bring a reasonable profit. Therefore the application of power costs to departmental production of units is a better method of cost analysis. To be sure, the expense attendant on ascertaining such costs must be justified. Hence for an item requiring only relatively small energy consumption for its production the installation of elaborate metering facilities would not be warranted. There is, however, a happy medium that lies in permanent metering installations where they are justified and periodic departmental tests where the energy consumption is not such an important part of the expense.

Here again is an opportunity for the industrial electrical engineer to follow production costs with the management and, through studies in determining the cost of electric power per unit of product, to find new methods of cutting production costs and increasing the efficiency of his equipment and department.

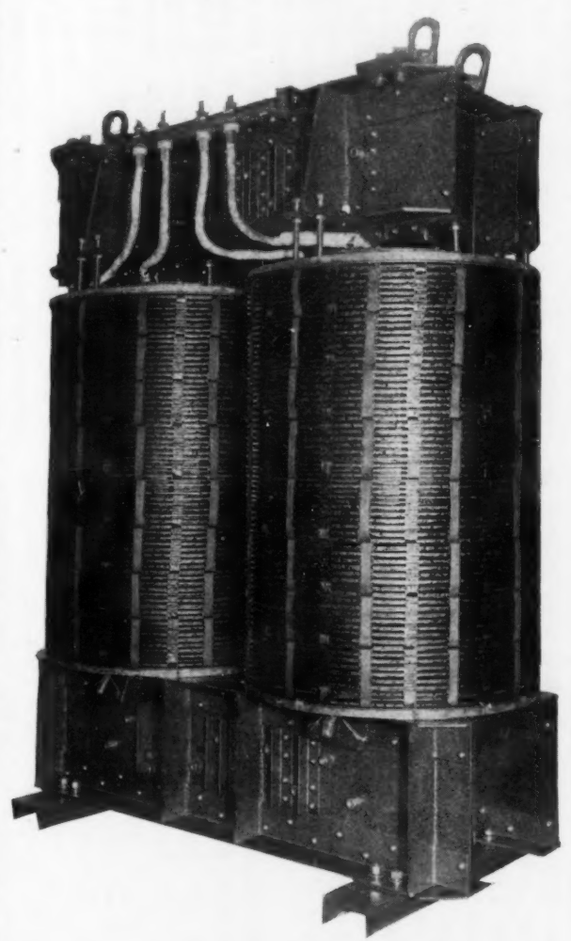
A New Pinnacle in Voltage Rating Reached in Power Transformer Design



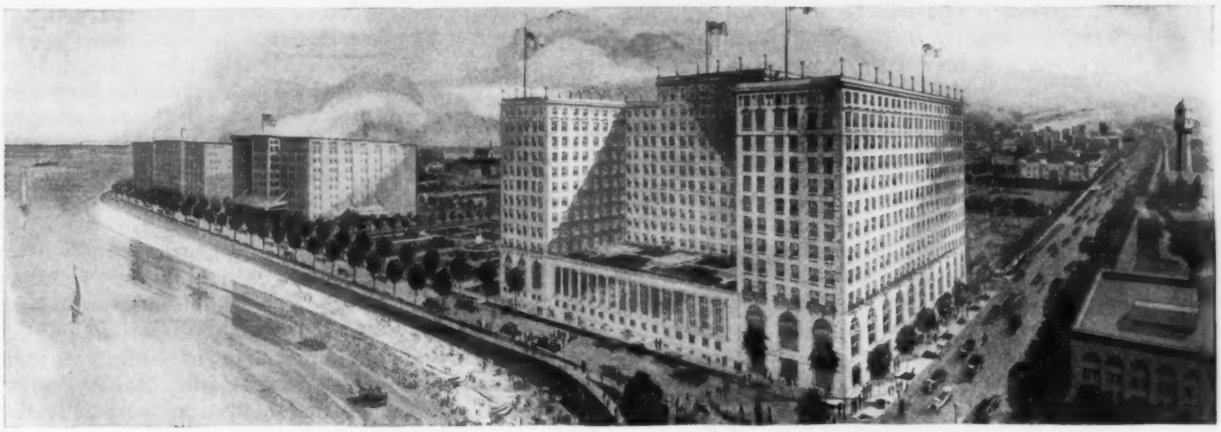
PRIOR to 1919, 150,000 volts was the maximum commercial potential for which power transformers had been required. In 1919 the next step was made when the Great Western Power Company decided to go into 165,000-volt transmission. It was in 1920, however, that the noteworthy increase to 220,000 volts was made by the Southern California Edison Company and the Pacific Gas & Electric Company in adopting 220,000-volt transformers for long-distance transmission. In meeting the requirements of this higher voltage service the manufacturers were faced with unusual problems which they have solved successfully. These developments were emphasized by the Electrical Apparatus Committee of the N. E. L. A. in its report delivered at the annual meeting this week.

On the left in this illustration is shown a 165,000-volt transformer with concentric circular coils, rated at 7,500-kva., developed by the General Electric Company. The 220,000-volt transformers of this company are of the same general character but since they are intended for operation on a system having a solidly grounded neutral, the line terminal is connected to the middle point of the high-voltage winding, joining alternate high-voltage coils on the two legs in series—the upper and lower halves of the two windings being in multiple. This results in approximately ground potential on the coils adjacent to the top and bottom horizontal core members.

On the right is the 16,667-kva., 60-cycle, 220,000-volt, transformer developed by the Westinghouse Electric & Manufacturing Company. Gradation of insulation is carried out in the same general way. The unit requires floor space of 11 ft. by 14 ft. 5 in.; the height of the tank is 14 ft. 9 in., and the height of the high-voltage bushing is 22 ft. 9 in. The cores and coils complete weigh 58,000 lb., and the weight of the unit complete with oil is 158,000 lb.



Optimism Keynote of N.E.L.A. Convention



Proceedings at Chicago Sessions Epoch-Making—Broad Aspects of Public Relations, Finance, Operation and Business Getting Discussed by Leading Executive and Engineering Talent of Industry and by Public Service Commissioners—Attendance of the Pre-War Kind in Number and Geographical Representation

THE convention of the National Electric Light Association held in Chicago this week marked the reawakening of that body to the vital problems confronting it and a determination to cope with them energetically and intensively to the end that the electrical industry may continue on its march of progress undaunted and unchecked.

Finance and public relations were the major topics up for discussion, and probably at no other time in the history of the association have so many executives, engineers, bankers and influential heads of the manufacturing and the jobbing trades been in attendance to take part in the deliberations and to support the various movements leading to the industry's upbuilding.

The questions of regulation were discussed from all angles by managers of utilities and by public service commissioners. Public relations, to the betterment of which the association has devoted so much time and publicity during the past few months, received earnest consideration. From without the industry manufacturers, bankers, publicists and government officials contributed their impressions of how utilities may best win public recognition and support, while from within the testimony of executives and others showed that the electric public utilities of the country are doing their part through excellent service at fair rates and through various channels of public information to carry the message of the utilities to the man in the street.

If there was any one outstanding feature of the convention which overshadowed all else, it was the high caliber of the men in attendance and the evident desire on the part of all to co-operate to the limit in all matters affecting the electric light and power business. Inductive interference problems which have been a subject of contention between the power and telephone companies for years are now in a fair way of amicable solution. The bond of fellowship which already unites the manufacturers of electrical apparatus has by constitutional amendment been extended to the jobbers also, so that a more harmonious relationship between all the branches of the industry is now virtually assured.

Samuel Insull in a masterful address on future expansion in the use of central-station power touched on some of the vital issues of the day and gave wholesome advice on superpower systems. It is fair to say that no session of the very many held during the week was without its important feature. In fact, the program was so crammed with excellent reports, papers and addresses that their immediate absorption and appreciation was out of the question during the sessions of the convention. Of more than passing interest were the addresses of President Insull, Halford Powell, Jr., Sidney Z. Mitchell, United States Solicitor-General James M. Beck, and Commissioners James A. Perry and E. I. Lewis.

While the serious side of the convention took almost all of the time, there was still enough left to enjoy the entertainment features planned by Homer E. Niesz and his committee. The big event in the entertainment program was "Derby Night." Electric horse racing, music and dancing made the evening one of fun, frolic and festivity.

First General and Executive Session

President Insull Reviews Present-Day Problems—Executive Manager Aylesworth's Report—Membership Gains 1,500

A MASTERFUL analysis of the fundamental economics affecting electric light and power company service, in which the attention of the industry was focused on the points of primary interest, was made by Martin J. Insull in his presidential address. Mr. Insull saw the industry in a wonderfully strong position but in need of tremendous sums of money to take care of the program of expansion demanded by the public. Money, he believed, must be obtained from the public, which necessitated therefore careful attention to good public relations. Finally, he saw the cessation of municipal regulation and operation in favor of state

regulation. The small-town plant was going. The big system feeding the small towns from a transmission line was taking its place.

"In general," said Mr. Insull, "the electric light and power business continues its growth. It is estimated that there is necessary and will be installed 1,000,000 kw. of generating capacity during this calendar year. We may, therefore, look forward to a promising future.

FINANCING

"It is estimated that for the next five years the electric light and power industry, in order to provide for the demands that will be made upon it by the public, will require approximately $1,000,000,000 per year. This vast sum will be spent for the necessary steam and hydro-electric generating equipment and transmission and distribution systems with all the appurtenances necessary to give service. If it cannot be provided, the public will be the sufferer. Where is it to come from?

"Under our regulatory laws, after paying all our operating expenses and providing depreciation, we have left only a fair return upon the actual amount of money invested in our properties for the public use. After paying a return to the people that have invested their money in the industry there is comparatively little left for further expansion such as we have been contemplating. It, therefore, must come from the investors, who are that part of the public that are thrifty and willing to invest their money in our industry because they have a firm belief in its stability and safety.

PUBLIC RELATIONS AND REGULATION

"On entering this period of vast money requirements we should give this question of our public relations the most careful consideration, as upon this very largely depends our ability successfully to take care of the anticipated requirements of the public. Under present regulatory conditions the public through their representatives determine the class of service we shall give, the rates we shall charge and the securities we shall issue. These representatives cannot help having their judgment more or less affected by public opinion. Equally true is it that those who spread their erroneous ideas as to the utility business in political campaigns are catering to an existing public opinion that we largely by our silence have allowed them to form. The investor would be more easily attracted to our business, which is one affected by a public interest, if he knew that it had behind it a generally favorable public opinion.

"During the past year various states have agitated the question of a change in the public utility laws so far as commission regulation is concerned. In most of the states it has been only agitation. In one state it resulted in the abolition of the state commission for the regulation of utilities, but it seems to be the consensus of opinion of those informed that it is only a matter of time when regulation must again take its place as it should in the advancement of the development of that state. In other states the agitation has taken the popular line of home rule by municipalities of their own utilities. In still another state the reverse position has been taken, and home rule has been submerged into state regulation. It can only be that the exponents of the home-rule ideas have lost sight of the great development in this industry that is taking place every day. They are not to be blamed for this, for many within the industry have not a full insight into these great developments."

EXECUTIVE MANAGER AYLESWORTH'S REPORT

An epitome of the year's work of the association was contained in the report of Executive Manager M. H. Aylesworth. The accomplishments had been gratifying, he stated, and while some might have felt that the association had been entirely too strenuous and ambitious in its program, the emergency had been great and the effort had been pitched accordingly. The result had been tremendous progress toward satisfactory alleviation of trouble caused by inductive interference, toward close co-operation between all branches of the electrical industry, toward the adoption of a uniform classification of accounts, toward obtaining rules and regulations which by their reasonableness will invite investment and toward better public relations.

The program for dividing the country into geographical divisions was going ahead rapidly, Mr. Aylesworth announced, and ten of the thirteen proposed divisions had already been organized and the other three were being formed.

Work at headquarters had been divided into four departments—engineering, service, committee activities and publicity. The engineering department, besides rendering direct service to many companies, had been co-operating with technical committees in handling inductive interference, safety rules, standardization, etc. During the year ended March 21 the service department replied to more than a thousand requests from member companies besides supervising the publication of *Rate Research* and the "Rate Book," assisting in the formulation of a uniform classification of accounts in co-operation with the National Association of Railway and Utility Commissioners and assisting in matters pertaining to rules and regulations of the Federal Power Commission. The department of committee activities had through the co-ordination of committee work obviated much effort that would otherwise have been duplicated. The national good-will campaign was planned and carried on by the publicity department. This department had sent out millions of booklets prepared by it and had written numbers of advertisements, articles for the magazines and the newspapers, besides assisting local companies in their publicity problems.

MEMBERSHIP

A gain of approximately 1,500 in membership over the preceding year was shown by the membership committee, of which Walter Neumuller was chairman. The total membership on April 30 was 11,106. Efforts were made this year to build the association through quality rather than quantity membership. The committee recommended that manufacturers, jobbers and contractor-dealers and their employees be divided into geographical divisions.

TECHNICAL ADVISORY COMMITTEE

The technical advisory committee, comprising Profs. Elihu Thomson, A. E. Kennelly of Harvard and Charles F. Scott of Yale considered some of the larger engineering problems and the probable trend of developments in the power industry together with their limitations. The committee contended that the immediate problem of producing power was not the discovery of a new method but the extension of the economical methods now available. It did not look for

any greater efficiency in steam-turbine practice and was of the opinion that any radically new method of producing power was not to be expected. Marked advances were being made in insulator manufacture both in form and in material, and without question improvement in cable construction for high-potential transmission in cities would become more and more a dominant factor. In the estimation of the committee there was an undoubted trend toward a single universal frequency.

PROGRESS IN WIRING SUPPLIES STANDARDIZATION

The first consideration of standardization in the report of the wiring committee, R. S. Hale chairman, was in connection with attachment plugs and receptacles. A large number of the manufacturers have adopted the parallel blade as standard. Member companies are urged to use standard makes where attachment plugs are required.

Reports were deferred in connection with the standardization of attachment plugs and receptacles for amperages larger than those allowed on lighting circuits and for 220 volts, etc., and also on appliance-plug standardization. As to plug connections for brackets and ceiling fixtures, the manufacturers recognize the desirability of this development and the importance of interchangeability. Lectures on wiring in printed form have been obtained and are now available.

Heater-cord tests have been completed and published. The committee now intends to make available to purchasers standards with which they can compare the cords on the bracket in order to encourage improvement in cord quality. At the same time work is being continued on abrasion tests. A standard form for use in purchasing cords has been prepared.

The committee is still of the opinion that in grounded systems the neutral should be solid from the generator or transformer to the lamps except so far as regards switches that may be needed for testing purposes, and that the size of the wire should be fitted to the maximum load rather than to a theoretical manufacturer's rating of the energy-using devices.

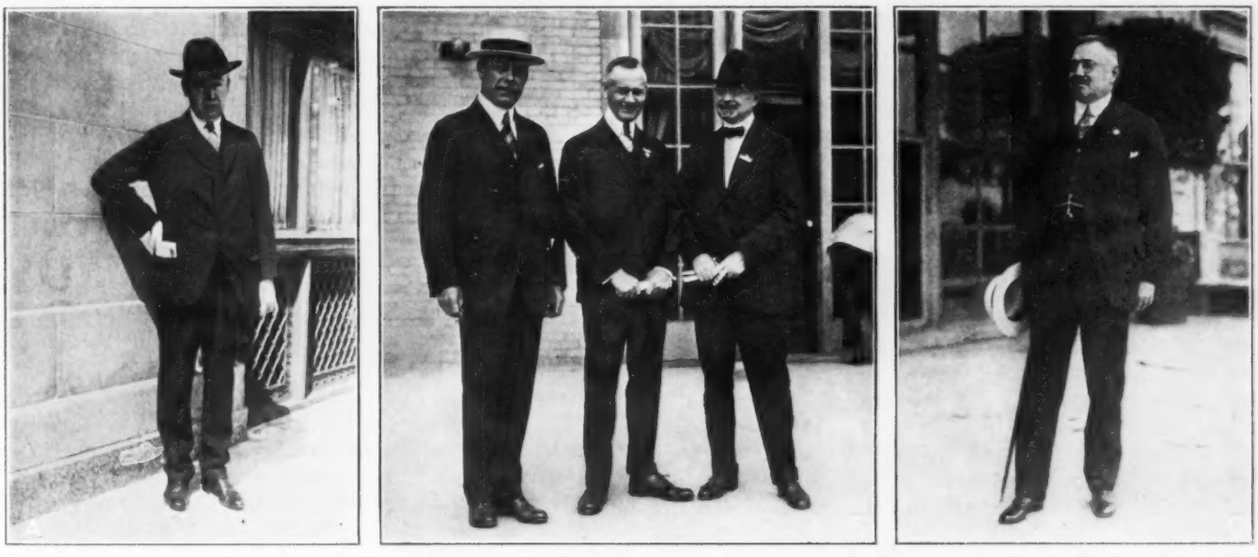
Second General and Executive Session

Samuel Insull and James A. Perry Make Notable Addresses—Superpower Survey Discussed—Reports of Rate Research and Lamp Committees

THE main meeting room was packed on Wednesday morning, at which time addresses were made by Samuel Insull, president of the Commonwealth Edison Company of Chicago, and James A. Perry, president of the National Association of Railway and Utility Commissioners. An abstract of Mr. Insull's address is printed elsewhere in this issue, and one of Mr. Perry's address will be given next week. The address of Mr. Insull and his reference to superpower surveys brought forth some discussion from Sidney Z. Mitchell, president of the Electric Bond & Share Company, New York City, and M. S. Sloan, president of the Brooklyn Edison Company. Mr. Mitchell cited the vast interconnected networks of the Northwest and Pacific Coast and of the Southeastern section of this country as evidence of the fact that economical methods of production and distribution of electricity are already in existence and that further developments in the superpower field will come as an evolution from within the industry. The difficulty confronting the Northeast section of the country was not attributable to the industry but to the archaic laws still in existence.

In reporting for the Superpower Survey M. S. Sloan said that the government had appropriated $100,000 for the study and that a number of utilities and manufacturing companies had contributed $50,000 more to complete the work. The chief difficulties were legal and financial rather than engineering. It was the purpose, he said, to seek a federal charter because of limitations imposed by state laws and the charters of the

President-Elect Bump and Four Executives Well Known to Electrical Men



A—M. R. Bump, chief engineer Henry L. Doherty & Company, New York City (N. E. L. A. (President-elect.
B—J. R. Lovejoy, vice-president General Electric Company, Schenectady, N. Y.; W. C. L. Eglin, vice-president and chief engineer Philadelphia Electric Company; E. W. Rice, Jr., president General Electric Company, Schenectady, N. Y.
C—John W. Lieb, vice-president New York Edison Company, New York City.

large public utilities involved. The committee was unanimous in its opinion that the superpower system should be controlled by the existing public utilities and financed by private capital.

W. S. Murray, chairman of the Superpower Survey, in replying to the comments of Messrs. Insull, Mitchell and Sloan, said he agreed with them that the system should be wholly within the control of the existing public utilities and financed by private capital. He paid a high tribute to the electric public utilities for their excellent and efficient work in power production and distribution.

EMPLOYEE ORGANIZATIONS

The committee on company employees' organizations, David Darlington chairman, which succeeded the committee on company sections, was engaged largely in advisory work along the lines of new organizations, education, handbooks and publicity. Because of the local nature of such organizations the committee pointed out the limited nature of the work that could be done by a national committee. It was thought that the value of this work could be greatly increased with the completion of the geographical organization of the national association.

RATE RESEARCH COMMITTEE

The service furnished to association members through the publication of *Rate Research* and the "Rate Book" was emphasized in the report of the rate research committee, of which Alex Dow was chairman. Two hundred member companies now subscribe for 314 copies of *Rate Research*. The committee recommended that one copy of it should be furnished to every company as a part of the service covered by the annual dues. The 1921 edition of the "Rate Book" is being enlarged to include cities of between 20,000 and 25,000 population.

Little progress toward unification of power-factor practice was reported, and the committee thought it unlikely to come about in the near future.

The committee discussed the problem of rate making for electric ranges and cautioned companies against undertaking that business at rates that did not take due account of all costs, with special reference to effect on peak load, as that would commit the company to a so-called increment cost rate for years to come.

INDUCTIVE INTERFERENCE

R. H. Ballard of Los Angeles, in reporting for the public policy sub-committee on inductive interference, told of the meetings held between executives of the National Electric Light Association and the American Telephone & Telegraph Company for the purpose of correlating their activities and jointly working out solutions to inductive-interference problems. While the engineers will continue their work, it was agreed that no precedents would be invoked in establishing the rights of either the telephone or electric light companies, but that both interests would seek the best economic solution of the problem. Bancroft Gherardi vice-president of the American Telephone & Telegraph Company, indorsed Mr. Ballard's statement and pledged the hearty support of telephone engineers in the work.

LAMP COMMITTEE

Continuing its policy of former years, the lamp committee, Frank W. Smith chairman, published in its report data for the past year which bring its curves, tables and charts up to date to the end of 1920. Special attention was given to the consideration of the correct terms to use to indicate the efficiency of the incandescent lamp. It was the endeavor to get away from the former term of "watts per candle," which was a designation of specific consumption rather than efficiency, and substitute for it "lumen" and "lumen per watt" as basic units for measurement of light output and of lamp efficiency. The larger manufacturers on Jan. 1, 1921, adopted this nomenclature. In addition, during the past year a revision of the standard specifications for incandescent lamps was undertaken.

The total sales of tungsten-filament lamps, excluding miniature sizes, in the United States during the year 1920 amounted to 202,000,000—an increase of 19 per cent over the previous year. In addition there were 9,000,000 carbon lamps sold, or 4,000,000 fewer than in 1919.

Special attention was given to voltage standardization, and the 1920 report, through a sub-committee report, went with much detail into the results of a questionnaire sent out to member companies inquiring as to their practice on standardization of voltages. A large increase is indicated in the demand for the standard voltages, particularly 115 volts to 120 volts. The 115-volt standard showed the greatest increase last year, the 120-volt increased but slightly, while the 110-volt standard continued even. Tabulations indicated that the past year had shown a very marked progress in the percentage of complete voltage standardization, and of the 520 member companies which replied to the committee's questionnaire this complete standardization rose from 79 per cent in 1920 to 96 per cent in 1921.

Third General and Executive Session

Water-Power Development Plays Chief Part in Day's Discussions—Federal Act Is Discussed—Success of Negotiations with New Commission

THE subject of hydro-electric developments, particularly in the Far Western sections, was given a prominent place on the program for Thursday morning. John A. Britton of the Pacific Gas & Electric Company, in a glowing portrait of California and its possessions, pictured the trend of development in that state from the days of the pioneers to the present, showing how, though at the present time out of a maximum of 9,000,000 water-hp. only 1,000,000 hp. is developed, the program adopted in California for the next five years will necessitate new plants at the rate of 100,000 hp. a year. He paid a high tribute to H. J. Pierce for his work in behalf of proper water-power legislation.

The committee on water-power development, Franklin T. Griffith chairman, reported on its meetings with the original Federal Power Commission in Washington early in February, 1921, at which time Secretary Merrill submitted to it the rules which he and his staff had prepared. After a prolonged discussion with Mr. Merrill and finding the rules too technical and severe, and to the committee's mind not a correct interpretation of the act, the committee declined to approve them. The Federal Power Commission then in existence, however, adopted the full set of rules and regulations on Feb. 28, including eleven rules which the committee agreed to and nine to which it could not agree.

The new Federal Power Commission took office March 4, and the N. E. L. A. committee immediately requested

a hearing, which was granted and held on March 25, 1921. At this hearing the committee frankly stated to the commission its views as to the rules then in force. After the hearing the committee remained in Washington for two weeks in conference with Secretary Merrill and his staff, at which time an agreement was reached as to revision of the rules with one exception. These revised rules were adopted by the commission on May 28, 1921, and are now in force. In the opinion of the committee, these rules provide a workable basis for administration of the water-power act.

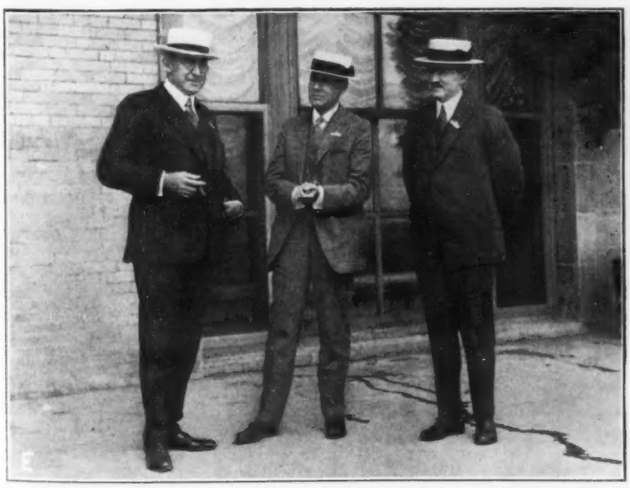
THE NEW WATER-POWER ACT

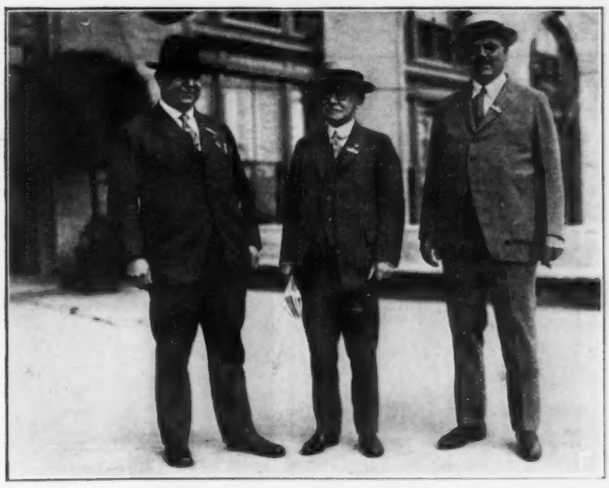
In discussing the report of the water-power committee, Henry J. Pierce of Seattle, Wash., who took a very prominent and vital part in insuring the passage of a reasonable water-power act, said:

"The water-power act of June, 1920, with the broad and liberal interpretation and construction placed upon its administration by the revised rules and regulations recently adopted by the Federal Power Commission, and which were largely prepared by the water-power committee of the National Electric Light Association, opens up the way for the speedy development of the water powers of the country. Up to the present time 223 applications for preliminary permits and licenses, for development of an aggregate of over 15,000,000 hp., have been made to the Federal Power Commission.

"The difficulty of utilizing our hydro-electric resources is that 70 per cent of the primary power used for manufacturing purposes is east of the Mississippi River, while 70 per cent of the hydro-electric resources of the United States are west of the Rocky Mountains. The total amount of primary power developed and used at present east of the Rocky Mountains for all purposes other than by railroad locomotives is 37,000,000 hp., and the total hydraulic resources of that region are about 15,000,000 hp., so that if every water power existing east of the Rocky Mountains were developed there would still be a shortage of 22,000,000 hp. to be supplied for present uses by steam. On the other hand, 40,000,000 water-hp. can be developed west of the Rocky

Prominent Executives Snapped Between Sessions in Drake Hotel, Chicago





A—Walter H. Johnson, vice-president Philadelphia Electric Company; I. E. Moultrop, assistant superintendent of construction Edison Electric Illuminating Company of Boston.

B—Arthur B. Lisle, general manager Narragansett Electric Lighting Company, Providence, R. I.

C—Frank W. Smith, vice-president and general manager United Electric Light & Power Company, New York City.

D—Bowen Tufts, manager C. D. Parker & Company, Boston, Mass., and president New England Geographic Division, N. E. L. A.

E—R. H. Ballard, vice-president and general manager Southern California Edison Company, Los Angeles, Cal.; H. T. Sands, president Haverhill Electric Company, Haverhill, Mass.; L. L. Elden, electrical engineer Edison Electric Illuminating Company of Boston.

F—O. B. Coldwell, vice-president Portland Railway, Light & Power Company, Portland, Ore.; John A. Britton, vice-president and general manager Pacific Gas & Electric Company, San Francisco, Cal.; F. R. Coates, president and general manager Toledo Railways & Light Company.

Mountains, and but 5,000,000 primary horsepower is used, of which 2,000,000 hp. is developed by steam and 3,000,000 hp. by water power. This leaves 38,000,000 hp. west of the Rocky Mountains now going to waste and yet to be developed.

ARTHUR WILLIAMS DISCUSSES THE ELECTRIC VEHICLE

In the electric vehicle the central station has an opportunity for an exceedingly profitable business, Arthur Williams of the New York Edison Company declared in his address at this session. He went on to point out the value of a thorough study of this method of transportation not only to the utilities but also to business at large.

Harford Powell, Jr., editor *Collier's Weekly*, made one of the hits of the convention in a trenchant address upon "Contact with the Public." He championed man-to-man relations between utilities and people, emphasizing the vital importance of sympathetically comprehending the viewpoint of the average citizen in public utility administration down to the humblest employee.

ACCIDENT PREVENTION

To health promotion, fire protection, operating methods and organization interest particular attention was given during the past year by the accident prevention committee, of which Charles B. Scott is chairman. Special consideration was given to electrical explosions or short circuits of great magnitude, the committee recommending that more study be bestowed upon the design and installation of current-limiting reactors, circuit breakers, instrument transformers and protective devices. In addition, ample clearances should be provided before interconnection with systems of large capacity are made.

Fourth General and Executive Session

Head of the Italian Railway Electrification Speaks—Election of Officers and Section Chairmen for the Coming Year

LOUIS A. FERGUSON, chairman of the committee on steam-railroad electrification, presented a report favoring the co-operation of electrical interests in studying transportation possibilities and problems, both technical and economic. Referring to the necessity for establishing railroad credit, the report declared that it is unthinkable that the American railroads should be subjected to the dread palsy of governmental operation.

W. C. L. Eglin filed the report of the committee on the president's address. John W. Lieb, representing the association on the National Industrial Conference Board and United States Chamber of Commerce, commended the work of these organizations in a comprehensive description of their activities.

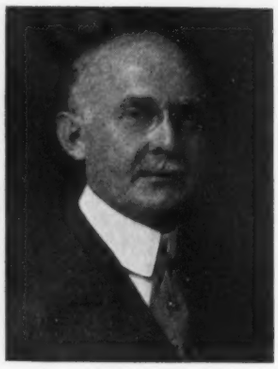
Guido Semenza, head of the Italian railway electrification commission, gave an interesting talk on water power and interconnection developments in Italy.

The convention came to a close with the election of officers as follows: President, Milan R. Bump; first vice-president, Frank W. Smith; second vice-president, Walter H. Johnson; third vice-president, Franklin T. Griffith; fourth vice-president, James E. Davidson; treasurer, Harry C. Abell (re-elected); executive committee for three years, R. F. Pack, I. E. Moultrop, E. W. Rice, Jr.; to fill vacancy caused by resignation of D. H. McDougall, Rawson Collier; jobbers' representative, W. E. Robertson. Section chairmen had previously been elected at the respective sessions as follows: Technical Section, N. A. Carle; Commercial Section, R. H. Tillman; Accounting Section, E. J. Fowler; Public Relations Section, Martin J. Insull.

MARTIN J. INSULL
Vice-President
Middle West Utilities Company

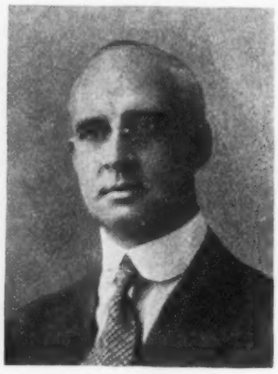
M. H. AYLESWORTH
Executive Manager
N. E. L. A.

FRANK W. SMITH
Vice-President and
General Manager
United Electric Light & Power Co.



WALTER H. JOHNSON
Vice-President
Philadelphia Electric Co.

FRANKLIN T. GRIFFITH
President
Portland Railway, Light & Power Company



J. E. DAVIDSON
Vice-President
and General Manager
Nebraska Power Company

Retiring President Insull, elected new chairman Public Relations Section; Executive Manager Aylesworth and the four vice-presidents elected for the coming year

Samuel Insull Outlines Future for Co-ordinated Service

President of Commonwealth Edison Company Emphasizes Fundamental Soundness of Private Development and Comments on Interconnection and Superpower

IN A STIRRING address Wednesday morning to an audience which crowded the main auditorium of the Drake Hotel, Samuel Insull, president of the Commonwealth Edison Company, surveyed the problems which central-station-company men now face. In contrasting the results of the recent industrial depression on business Mr. Insull pointed out that the central-station industry has felt the pressure in the shape of a decreased percentage of increased growth and a difficulty in acquiring the necessary funds to provide plant and equipment to take care of business offered. He urged, however, that business-getting departments should show new vigor and try to get in a position where monthly receipts will show increases.

In pointing out that the universal use of electric service means greater diversity and consequently high load factor, Mr. Insull referred to the situation in Montana, where there is a load factor of 78 per cent and a consumption of energy of 2,000 kw.-hr. per capita, and to similar conditions on the Pacific Coast, where there is a load factor of about 60 per cent and a consumption of about 1,200 kw.-hr. per capita. In New York City, Mr. Insull stated, the load factor is about 40 per cent with a kilowatt-hour per capita sale of 450 kw.-hr. Chicago has a load factor of about 45 per cent and a consumption of about 700 kw.-hr. per capita. He pointed out that these various percentages depend on the nature of the business served and referred to an address which he made before the American Institute of Electrical Engineers in New York, predicting that if Greater New York and the territory immediately tributary to that city were interconnected and steam railroads electrified, a load factor similar to that existing on the Pacific Coast and in Montana was possible. He stated that the difference between the load factor of New York and Chicago of about 12½ per cent is owing to the fact that all the energy consumed within the latter city is produced under one organization.

By the aid of a map of the States of Indiana, Illinois, Wisconsin, Michigan, Ohio and Kentucky Mr. Insull showed the status of interconnection of the systems which he operates. The territory from northwest of St. Paul and Minneapolis to St. Louis and Louisville on the south is interconnected today practically in one system, with the exception of about 115 to 120 miles in three separate gaps, where the interconnection has not been made partly because of the cost of money and partly because at this particular moment the industrial advantages to be obtained are comparatively slight. Atlantic seaboard. On this subject Mr. Insull said in warrant. The Commonwealth Edison Company contemplates building at Waukegan, north of Chicago, just this side of the Wisconsin border, a large power station on the lake, which while taking care mainly of the territory immediately north of Chicago and supplementing the small water powers and steam stations on the various rivers of northern Illinois, will virtually act as a steam reserve across to the Mississippi River and away up into central Wisconsin.

This discussion of the Middle West interconnection led to comments on the Superpower System for the Atlantic seaboard. On this subject Mr. Insull said in part:

"The map behind me represents Illinois, Indiana, portions of Michigan, Wisconsin, Ohio, Keokuk and St. Louis. With virtually the same population it produces about the same kilowatts, burns 13 per cent more coal because of the lower efficiency of the fuel, and produces 40 per cent more energy from water power than is produced in the territory of the proposed Eastern superpower scheme. We have not called it by the same name, but we have been actually doing the same work that it is proposed should be done on the Atlantic seaboard. We have some advantages. We have possibly more enlightened legislation on the subject. The question of condemnation under the law of eminent domain is accorded to us to a greater extent in the territories of the Mississippi Valley than it is accorded in the territories along the Atlantic seaboard. That to my mind is probably one of the most important things. The necessity compelled us to go ahead. I have had to learn the fact that the greater the territory that you can cover the greater is the diversity of the demand for your product and that consequently the better are your operating conditions because of your better load factor.

"As to the superpower scheme, I do not want to be taken as being in any way unfriendly to that scheme. I want to emphasize here the importance of the National Electric Light Association and its member companies taking a far more active part in this situation than we have done in the last year or so. Remember, we are likely to get legislation through Congress, or proposed legislation presented to Congress, that may be very desirable for the people operating within the territory, the comparatively small territory, along the Atlantic seaboard, but might be very undesirable for people putting out just as much energy in the Mississippi Valley or the Rocky Mountains or on the Pacific Coast.

"I should like to see every committee of this association watch the progress of any plans of federal control of our business. I think we can be of great help in the rehabilitation of steam railroads of this country, but I am not one that believes in universal electrical propulsion of railroads immediately. I believe that the economic way to get around to that proposition is to develop our production of energy along economic lines and to develop the transmission of that energy throughout the country on economic lines; to see to it that at any time where electrification of steam railroads is desirable in some particular locality we shall be able to take care of it. I see no reason why we should not finance that operation right up to the point where our energy is taken by the prime mover of the railroad—that is, the locomotive—and in that respect I think we can be of very great assistance; but in all these investigations—and I have studied some of the figures sent out from Washington—there should be the stabilized knowledge that exists in this industry and in this association and its members as the result of forty years of work in the manufacture of energy. The nation is entitled to the benefit of it, the industries are entitled to the benefit of it, and we are entitled to the benefit of it to the extent that it will stabilize our investment to a greater extent than it is stabilized today and will help to reduce the cost of our product and enable us to sell it at cheaper prices to all of our customers, as well as to those who want to purchase it in very large quantities."

Edward N. Hurley Discusses Knowing One's Customers

IN HIS address on "Do We Know Our Customers?" before the Public Relations Section, Edward N. Hurley, Hurley Machine Company, emphasized the importance of the human element in business. Managers of corporations who do not know what the man in the street is thinking about and have a feeling that their company is so large and powerful that they do not have to give special attention to their old customers are living in the past, he said, and it is only a question of time before reaction will start and it will then require heroic work on the part of the new management to save the property.

Not over 7 per cent of the executives, advertising agencies and sales managers of the corporations in this country have correct information as to the facts and figures regarding their customers, prospective customers or the merchandising methods of their distributers and dealers, Mr. Hurley continued.

Mr. Hurley suggested that the executives of all the electric light and power companies in the country ascertain by personal letters to their customers the general feeling of those customers regarding the electric service they are receiving. In connection with this he said:

"I firmly believe that a national survey along the lines indicated would show that the vast majority of the consumers of electric light and power are absolutely satisfied with the service they receive and have confidence in the managers and men who have built up and developed the great electrical industry."

Public Policy Meeting and Electric Vehicle Luncheon

AT THE public meeting under the auspices of the public policy committee on Thursday evening the principal speaker was James Montgomery Beck, who last week received from President Harding an appointment to be Solicitor-General of the United States. His topic was "Benjamin Franklin, the Pioneer Electrical Engineer and Philosopher."

Sidney Z. Mitchell, Electric Bond & Share Company, presented the report of the public policy committee. An abstract of this report, which touched upon the very fundamentals of the industry, will be found in the report of the Public Relations Section.

ELECTRIC VEHICLE LUNCHEON

Three hundred delegates and fourteen of the foremost leaders of the industry assembled Wednesday noon at the Hotel Drake and received in ninety minutes more testimony as to the value of storage-battery transportation than probably ever before was conveyed to an audience in an equal period of time. The array of distinguished men who by their presence indorsed the electric car and the character of the speakers who "stood up and were counted" for "electrics" made the occasion literally unique in the annals of commercial transportation.

F. J. Bridges of the Hydrox Company, Chicago, for fifteen years a purchaser and user of motor transportation, testified that within 30-mile to 35-mile running limits the electric vehicle operates at lower cost than horses and meets the requirements in better fashion than its other competitors. Samuel Insull, president Commonwealth Edison Company, emphasized the low central-station investment required to care for electric trucks and the value of this load from the revenue and off-peak standpoints. John W. Lieb showed how the electric truck, industrial and road types, can reduce the cost of commodity handling. Arthur Williams, after paying an earnest tribute to the work of James H. McGraw in spreading the vehicle gospel, cited sales instructions of a gasoline truck maker, indicating that competitors have a genuine fear of the "electric" in certain fields. Mr. McGraw, speaking from twenty years' personal interest in electric vehicle development, maintained that, in view of the accomplished results, the time has come for a change in the psychological attitude toward electric vehicles. He paid a high tribute to Chairman E. S. Mansfield's constructive work in the electric vehicle field. The meeting closed with the general feeling that a new day has dawned in storage battery transportation.

Current Aspects of Utility Regulation

SPEAKING at the Thursday session on "Current Aspects of Utility Regulation," E. I. Lewis, formerly chairman of the Indiana Public Service Commission and now by appointment of President Harding a member of the Interstate Commerce Commission, reviewed in a dramatic way the abnormal business conditions that arose upon the signing of the armistice. Continuing, he said:

"We came up to the present year of our Lord 1921 dazed. Commodity prices began to break. Labor was becoming so easily available that employees began again to show efficiency. The lordly coal supply man lapsed back into the almost forgotten habit of taking his hat off to the trade. Red figures began to go black. Regulating officials and public utility managers began to see mirages of reductions in rates.

"Let us see if we can analyze the situation. Why are utility rates failing to fall readily and comparably with commodity prices? One reason, forgotten by a public that generally will be reasonable when it stops to reason, lies in the fact that utility rates, as a whole, did not advance comparably with commodity prices. One may truthfully say that utility rates have advanced very little from the pre-war levels. When every one else—corporation, farmer, laborer, wholesaler, retailer, property owner—sailed away on the wild war-period flight, the public utilities and common carriers alone were anchored to mother earth by regulation at no time overgenerous and often close to the point of starvation.

"Still another reason for failure of public utility rates to drop: While public and industrial demand called for expansion of plants there is now generally present a vast amount of physical emaciation. It can no longer be ignored. When the war was upon us President Wilson commanded scrupulous husbanding of men, materials and money for the big job of winning the war. Maintenance and rehabilitation suffered. Then followed the most unfavorable financing period utilities have known and constantly mounting operating costs, accompanied by increasingly unfavorable financial showings. The result is that many utilities emerge from the years 1917-1920 in depleted physical condition."

Mr. Lewis condemned certain specified practices of some utilities and ended with an eloquent and well-reasoned plea for an era of better understanding between the three bodies concerned—the utilities, the commissions and the public.

Addresses of Section Chairmen

High Spots in the Work of the Public Relations, Technical, Commercial and Accounting Sections During the Past Year

A BRIEF report of accomplishment and a few recommendations were made by James E. Davidson, chairman of the Public Relations National Section. This section, now completing its first year, undertook to better relations between the light and power utilities and labor, electrical manufacturers, jobbers and dealers, and particularly with the public, and to promote co-operation with investment bankers. An important part of this work was the preparation and distribution of publicity material, such as the "Kilo Watt" Series, which has now gone over the ten-million mark for the first and second series; booklets, addresses and advertisements, including the association's own campaign in the *Saturday Evening Post*.

Co-operation was obtained from the Investment Bankers' Association of America, which passed helpful resolutions and sent publicity material specially prepared for the purpose to its customers.

Public utility information bureaus have been formed in ten states, and the report urged that similar bureaus be formed in other states as quickly as possible.

The manufacturers and electrical trade press are thanked for their generosity in the co-operative advertising campaigns, and particularly the McGraw-Hill Company, which, the report stated, rendered especial service through its *Collier's Weekly* campaign, "which has particularly benefited this movement."

The committee made a number of recommendations. Every company is urged to do at least a part of its financing by the sale of securities to the public. One or more employees of each company should be groomed to make talks before local organizations. A wider subscription to the "Kilo Watt" series and other booklets is urged. All material prepared by the publicity department should be ordered by the state committee on public utility information for regular distribution. The formation of a committee on relations with educational institutions which will arrange for lectures, booklets, etc., is recommended, so that students at colleges and other institutions of learning shall be taught the economic position of the utility. All employees of the electrical industry should be informed so that they may talk intelligently of the utility.

TECHNICAL SECTION

Some inquirers have raised the question whether the N. E. L. A. should devote so much time to technical work, especially when there are so many engineering societies in the country apparently working to the same end. I. E. Moultrop, chairman of the Technical Section, pointed out that the N. E. L. A. does not duplicate the work of any other society, but rather takes up the work where the engineering societies leave off. Engineering societies by their constitutions are prevented from doing commercial work, but the N. E. L. A. is not restricted in this way. Attention was also called to the important progress which has been made toward co-operation with the communication companies in the solution of inductive-interference problems.

The frequency and place of committee meetings deserve further study, Mr. Moultrop asserted, although the problem will be somewhat simplified when each geographical division has a technical organization functioning with the national committee. He indorsed the plan adopted this year when a group of committees met in New York and accomplished more collectively in two or three days than could have been accomplished by the separate committees in the same time. He also reviewed briefly the activities of the technical committees.

COMMERCIAL SECTION

M. S. Seelman, Jr., the chairman of the Commercial National Section, pointed out in his address that if executives are to get the most and best out of their properties they must think along broad commercial lines. The commercial elements of their organization should be encouraged and developed and have the fullest possible scope in all dealings with customers and all relations between public and company.

Reviewing the work of the Lighting Sales Bureau, Mr. Seelman pointed out that the same opportunity to improve conditions and increase income that has been shown by the industrial campaign exists in the field of home lighting and called attention to the home-lighting demonstration at the convention. The work of the Power Sales Bureau for the past year was based upon the postulate that the present job of the power salesman is to help the central-station company's management to secure the largest return on a given investment and at the same time, in order that the element of mutual advantage may be present, to obtain for the customer a profitable investment in purchased power.

A real begining was made this year in the testing of electrical appliances, and in some respects this work has been pure pioneering. It is hoped to put the business of merchandising appliances on the same business basis on which the business of merchandising lamps now rests so far as regards the standardizing of the tests of the lamps and the resulting superior average product. Closely related to merchandising is the question of advertising and publicity, which has called for an increased use of the electrical page and the working out of the model electrical home idea.

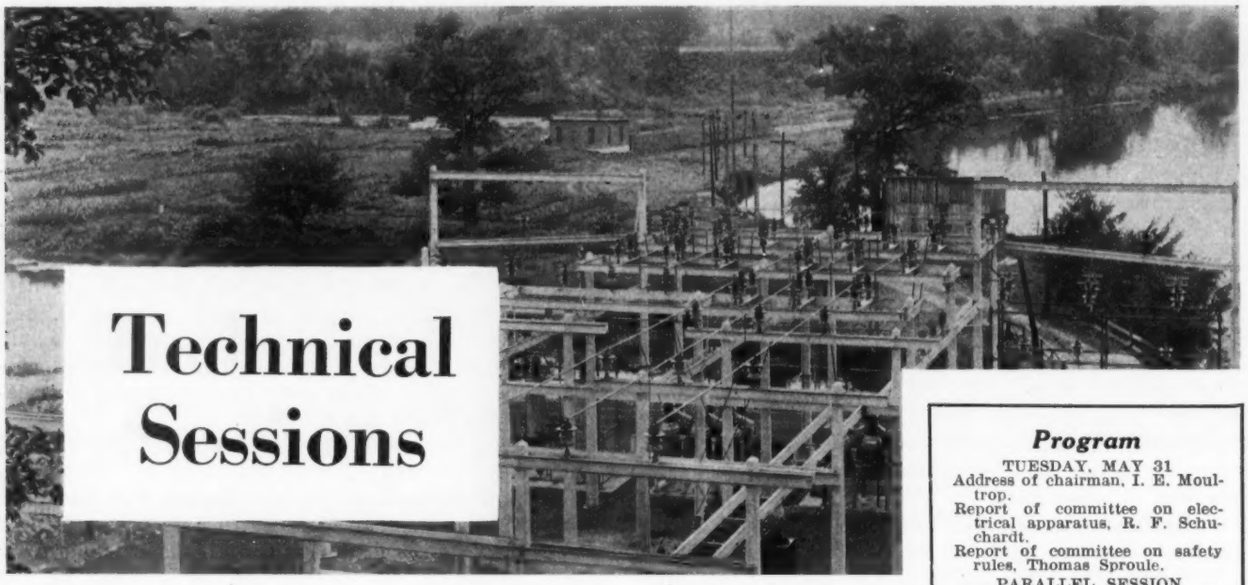
Valuable information was given on electrical vehicles, covering among other things the progress made in establishing electrical garages.

ACCOUNTING SECTION

Reviewing the work of the Accounting Section for the past year, Chairman J. C. Van Duyne outlined the organization of the various committees. Of the twelve committees previously organized it was directed by the section that two—one on uniform classification of accounts and relations with other associations and one on form of annual reports to commissions—be consolidated; that three be discontinued, namely, the insurance committee, now a national committee, the merchandising accounting committee and the motor-vehicle records committee, both of the latter having fulfilled their functions.

Organization under the geographic division plan has progressed throughout the year, and a fairly complete tie-in between the division accounting sections and the national Accounting Section has been made possible.

Commenting on the standardization of accounts as prescribed by state commissions, Mr. Van Duyne reviewed the progress made since 1914 and also the work of the joint committee of the electric and gas associations which collaborated with the Association of Railway and Utilities Commissioners in formulating a uniform standardized classification of accounts for adoption by all states.



Technical Sessions

Program

TUESDAY, MAY 31
Address of chairman, I. E. Moultrop.
Report of committee on electrical apparatus, R. F. Schuchardt.
Report of committee on safety rules, Thomas Sproule.

PARALLEL SESSION
Report of meter committee, W. L. Wadsworth.

WEDNESDAY, JUNE 1
Report of committee on overhead systems, W. K. Vanderpoel.
Report of committee on inductive interference, A. E. Silver.

THURSDAY, JUNE 2
Report of committee on hydraulic power, Markham Cheever.
Report of committee on prime movers, N. A. Carle.

PARALLEL SESSION
Report of committee on underground systems, F. E. Ricketts.

I. E. MOULTROP, chairman of the Technical Section, in reviewing the activities during the past year, dwelt upon the importance of the work of technical committees, saying that they do not duplicate the work of other societies but co-operate with them to advantage. During the year 300 men have been at work on the technical committees. An interesting plan was successfully carried out this year, he said, when 250 men met simultaneously with their committees in New York. More was accomplished at this time, he believed, than could have been done by the separate committees. He also called attention to the work of the hydraulic power committee, which functioned this year for the first time.

Of particular importance was the co-operative spirit entered into between N. E. L. A. representatives and the communication companies in the matter of inductive interference. Mr. Moultrop also spoke of the activities of the consultant group, composed of Profs. Elihu Thomson, A. E. Kennelly and Charles F. Scott.

Prime Movers

The specification of lubricating oils and the economy of burning powdered coal were discussed, following the prime mover report by N. A. Carle, chairman. The comments on burning pulverized fuel developed into a lively and almost heated discussion in which ardent and eloquent advocates of both forms of combustion took part. Lubricating oil is particularly interesting, it was said, because there has been a mystery enshrouding the subject for several years that should now be dispelled. The report is abstracted on page 1311.

The recommendations on lubricating oil are the first that have been submitted and are very important and valuable, it was said. Opinions of oil refiners, turbine manufacturers, operating companies, the Bureau of Standards and others have been considered in preparing the recommendations. In commenting on the report, Mr. Larsen, Sinclair Oil Refining Company, claimed that some of the tests recommended are not absolutely necessary and should be made optional. He expressed the belief that tests of viscosity, acidity, emulsion, corrosion, flash temperature, etc., should be sufficient.

The viewpoint of the Bureau of Standards was expressed by W. H. Herschel, who said that the routine tests were based on government specifications and declared that it is a mistake to establish too many new specifications in view of the increased price which oil refiners would consequently have to charge.

Viewpoints of three manufacturers were expressed by E. H. Sniffen of the Westinghouse Electric & Manufacturing Company, A. C. Flory of the Allis-Chalmers Manufacturing Company and R. B. Beale of the General Electric Company, each expressing the opinion that operating engineers are in a better position to determine the basis for lubricating oil specifications than are manufacturers.

Opinions of three operating companies were expressed by R. J. C. Wood, Southern California Edison Company; H. M. Cook, Brooklyn Edison Company, and W. L. Abbott, Commonwealth Edison Company. Mr. Wood referred to deposits of iron oxide and emulsification which had been particularly troublesome. In one case the deposit in an oil tank was found to consist of 60 per cent iron oxide caused by acid in the oil eating the oil pipes. The acid also corroded the oil-pump valves.

Mr. Cook called attention to increased trouble with corrosion where salt water is used for cooling oil and said that this trouble can be minimized by using monel-metal instead of brass. Mr. Abbott said that it had been his experience that emulsion may be converted to pure oil and water by heating to 250 deg. F., but it is usually cheaper to buy new oil.

In commenting on the fuel-oil situation, Mr. Larsen advocated the burning of low-gravity fuel oils since they have a higher B.t.u. content per gallon, are cheaper per volume and are not so easily cracked as higher-gravity oils. Furthermore, they are not subject to such extreme fluctuations in price.

An unusually entertaining and exciting discussion for a technical session took place when advocates of powdered-fuel burning equipment and stokers were

given an opportunity to present the merits of the equipment they favored. Manufacturers and operating engineers took part. Among them were John Anderson, Milwaukee Electric Railway & Light Company; W. J. Santmyer, Puget Sound Light & Power Company; H. D. Savage, Combustion Engineering Company; F. A. Sheffler, Fuller Engineering Company, and Joseph Harrington, Brady Foundry Company.

Mr. Santmyer, who was introduced as the engineer who had burned 120 acres of mud flats, referred to experiments of burning powdered fuel in the Northwest, particularly in twelve plants around Seattle. "Powdered-fuel plants have come to stay," he declared emphatically. Efficiencies are obtained which are unbelievable, boilers can be forced to remarkable overloads, and equipment is particularly flexible in operation. In an endeavor to substantiate these statements he referred to one 500-hp. installation where the boilers could be put on the line and made to carry 300 to 400 per cent rating in forty minutes.

In defending the high expenditures often attributed to powdered-fuel plants Mr. Sheffler pointed out that the excessive expense often cited is due to including the cost of considerable equipment which displaces apparatus ordinarily used with boilers fired by other means. While he did admit that powdered-fuel equipment cost more than other combustion equipment under some conditions, it is usually less expensive for stations rated at 5,000 hp., or greater, he declared.

The excitement started when Joseph Harrington took the side of the stoker manufacturers and commenced to show what a competitor powdered-fuel equipment has in modern stokers. He asked: "What does efficiency amount to if it doesn't reduce the total cost?" If stokers are assumed to have 80 per cent efficiency and powdered-coal installations are assumed to have 85 to 88 per cent efficiency, the relative costs of the installations will be in about the same proportion, so that the powdered-fuel installations will have to have considerable offsetting advantages to justify their use. Furthermore, he pointed out, burning of powdered coal adds complications and probability of breakdown. What is needed is simplification, reliability and low total operating costs. Contending that costs of pulverizing coal increases very rapidly as the percentage of inert material goes up, he questioned the economy of burning any powdered coal containing more than 15 per cent ash or 8 per cent moisture. He decried the comparisons which had been made between powdered-coal installations and obsolete stoker installations, saying that modern stokers can burn anything from lignite to anthracite coal and have horizontal efficiency curves from 150 to 250 per cent rating, can increase from 150 to 250 per cent rating in three to four minutes and can burn coal containing 40 per cent ash without clinker formation of excessive maintenance expense. Powdered-fuel combustion is limited in the small amount of excess air which can be admitted, he declared, because of the excessive furnace temperatures which destroy the brickwork. In stokers, on the other hand, the brick deterioration is much less with the same reduction in excess air. As to forcing rates, he contended that modern stokers can burn up to 60 lb. of coal per square foot per hour and in a few months new stokers will be made available which will burn as high as 100 lb. of coal per square foot per hour. In closing he declared that he was in favor of powdered-coal combustion under certain conditions, but held that what the industry needs now are facts that will permit equitable comparisons.

Mr. Santmyer contended that in the Northwest coals containing 28 per cent moisture and 16 to 22 per cent ash have been burned, and the cost of drying, pulverizing and delivering to the furneces is only 72 cents per ton.

Mr. Anderson was a very enthusiastic supporter of powdered fuel and expressed one operating engineer's viewpoint when he said that the new Lakeside plant at Milwaukee has developed unbelievable efficiencies, gives the best performance which can be expected, and all at an operating and maintenance expense which is considerably less than before. He expressed the hope that the stoker which Mr. Harrington prophesied would materialize, but said that he could not believe that any engineer could present a reasonable argument for installing stokers after seeing the powdered-fuel installation in the new Lakeside plant. He concluded by saying that in the Oneida plant, which has six stoker-fired boilers and five powdered-coal boilers, the powdered-fuel installations are always used when extra forcing is necessary.

An Operating Code Being Formulated

There are many excellent operating rules and regulations in effect, but there are as many different kinds as there are operating companies. Recognizing this fact, the prime movers committee, of which N. A. Carle is chairman, has started the compilation of all operating rules in order that the best ideas may be selected and made available for operating companies. So far considerable progress has been made in developing the probable scope of the recommendations which it will eventually make, but the actual collection of rules and regulations remains to be completed. In outlining this work Mr. Carle points out that just because a company does not have printed rules entitled "Operating Code" is no reason why it cannot compile what rules it has in the form of blueprints, typewritten sheets, verbal instructions, etc., and send them to the chairman of the prime movers committee. By doing so no company will obligate itself to observe these practices, since the information is only desired in order to prepare a collection of recommended practices. After all the rules have been compiled, the recommendations will be published so that a discussion by correspondence may be conducted. Following this a public hearing will be held and thus a tentative code will be devised.

Mr. Carle emphasized that this code is not going to be forced on operating companies. It will be for their voluntary use only. He also pointed out that it will supplement the existing A. S. M. E. code, which covers only the requirements at the time of accepting equipment and conducting performance tests. The N. E. L. A. code will apply to those conditions which exist for fifteen to twenty years of operation after the installation of apparatus.

Hydraulic Power

On account of the rapidly growing importance of water power it was decided at the convention at Pasadena last year to organize a hydraulic power committee to give special consideration to problems of water-power development and operation. During the first year of the committee's existence, under the chairmanship of Mark-

ham Cheever, a great deal of time was required to work out the organization in preparation for comprehensive activities.

Of the technical problems considered by the committee, the development of efficient draft tubes, the control of tailwater level, the relation between rainfall and stream flow, evaporation, and the operation of hydroelectric plants for maximum output received the most attention.

Regarding the design and construction of waterwheels attention is called to the 55,000-hp. turbines to operate under 305-ft. (93-m.) head for the Queenston-Niagara station of the Hydro-Electric Power Commission of Ontario, a distinct advance in the size of reaction wheels. Mention is also made of the use of 22,500-hp. turbines under 800-ft. (245-m.) head at the Kern River No. 3 station of the Southern Califronia Edison Company. This represents the highest head to which reaction wheels have been applied. Another feature of even greater interest is the improvement in efficiency curves. The flat curves of newer wheels, and particularly the high value at part gate opening, are of the greatest importance to the operator in obtaining maximum energy output from available water supply and under varying load conditions met in practice. Progress has also been made in the application of high-specific-speed, unshrouded, propeller type of runner to low heads.

A moving picture of the Pitt River developments now under way in California by the Pacific Gas & Electric Company enlivened the discussion of the hydraulic power committee's report. John A Britton outlined the major features, including the river flow, which is remarkable for its constancy, and P. M. Downing pointed out that eight plants, of which three are under design or construction, will be eventually constructed over a length of 35 miles of river between Fall River and Big Bend. A total of 500,000 kw. will be developed.

W. N. Ryerson of Duluth outlined some penstock troubles that have been encountered, mentioning the splitting of redwood staves and corrosion of steel pipes. The conclusion has been reached that treatment of steel is useless unless the metal has been thoroughly cleaned by sandblasting.

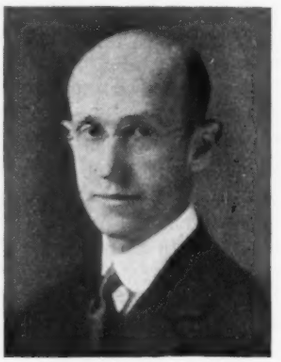
W. W. Tefft said that the chief object of his development is not the production of a head increaser, but to reduce the length of the spillway section of the dam and lower construction costs. The use of bursting plates is a waste of money, R. J. C. Wood of Los Angeles asserted, unless plates are put at the point where trouble occurs.

In California a marked difference of available water is experienced in years when rainfall is equal if the preceding seasons have been either wet or dry. For

N. A. CARLE
Chief Engineer
Public Service Electric Co.

R. F. SCHUCHARDT
Electrical Engineer
Commonwealth Edison Co.

W. K. VANDERPOEL
Superintendent
Public Service Electric Co.



MARKHAM CHEEVER
General Superintendent and Chief Engineer
Utah Power & Light Co.

W. L. WADSWORTH
Superintendent of Meters
Minneapolis General Electric Co.

F. E. RICKETTS
Superintendent Electric Stations
Consolidated Gas, Electric Light & Power Co.

A. E. SILVER
Electrical Engineer
Electric Bond & Share Co.

THOMAS SPROULE
Assistant Superintendent
Public Service Electric Co.

Chairmen of technical committees who presented reports at the Chicago convention: Mr. Carle, committee on prime movers; Mr. Schuchardt, committee on electrical apparatus; Mr. Vanderpoel, committee on overhead systems; Mr. Cheever, committee on hydraulic power; Mr. Wadsworth, committee on meters; Mr. Ricketts, committee on underground systems; Mr. Silver, inductive interference; Mr. Sproule, safety rules.

this reason, in estimating water supplies available in any season the records of the preceding seasons must be considered.

Electrical Apparatus

New practices and tendencies in the use and operation of electrical apparatus were the subject of an entire afternoon's discussion. The report of the committee, of which R. F. Schuchardt is chairman, is presented in abstract on page 1314 of this issue. Among the subjects which elicited the most interest in the discussion were the following: Closed system of generator ventilation, methods of maintaining heat balance, auxiliary drive, radio-telephoning for load dispatching, protection of reactors, oil-circuit-breaker rupturing capacity, and standardization of service voltage.

H. R. Summerhayes, General Electric Company, called attention to stresses as high as 200 lb. per inch in reactor conductors. Theoretically, he said, the closed system of ventilation should permit the use of nitrogen as the cooling medium for generators, but difficulty would be experienced in avoiding its dilution with oxygen that might leak in. However, the system does facilitate the use of CO_2 for fire extinguishing. A central starting bus for auxiliary motors was favored because it permits the use of large enough circuit breakers to clear faults. Kenetrons are being used for high-voltage direct-current tests, Mr. Summerhayes declared, but they alone are not strong enough to break down faults at the present stage of development. For this purpose mercury rectifiers with their coils connected for maximum voltage have been used. The more extensive use of mercury rectifiers in Europe is due to the higher efficiency obtained with the higher voltage used there, he contended.

R. J. C. Wood, Southern California Edison Company, asked what the lowest voltage at which differential relays would operate should be, pointing out that too low a value might cause unnecessary interruption of service whereas too high values might permit great fire damage.

B. G. Jamieson, Commonwealth Edison Company, Chicago, suggested that some information be compiled on the application of automatic control to feeder circuits. Considering reliability, he contended that it is preposterous to think of a reactor ever failing and said that the Commonwealth Edison Company is connecting auxiliary motors between bus sections to prevent losing them in case one bus section "goes down."

Manufacturers have promised static apparatus that can be used in place of rotating apparatus to supplement the kenetron for high-voltage direct-current testing, he said.

F. W. Smith, United Electric Light & Power Company, New York, urged that information be obtained regarding the performance of alternating-current motors for elevator service where the speed is 350 ft. per minute or more.

F. C. Hanker, Westinghouse Electric & Manufacturing Company, expressed a general need of experience from operating companies with high-potential tests for generators. Tests will be completed shortly, he declared, from which manufacturers can judge the rupturing capacity of oil circuit breakers more accurately.

Three interesting practices of the Detroit Edison Company were related by Alex Dow, namely, (1) the operation of house turbines in parallel with the main generators without experiencing the troubles usually anticipated, (2) the segregation of power supply and provision of network interconnection that prevent the failure of one station pulling another down or requiring the indiscriminate disconnection of loads, and (3) the use of radio telephony for load dispatching. The house turbine is run on the throttle to prevent its seizing the load in case of drop of main generator frequency. To avoid its slowing down with the rest of the system during a disturbance, low-voltage or low-frequency relays might be used to separate it electrically from the main units, but this method is not entirely satisfactory.

Just enough interconnections are provided between the networks served by the Delray and Connors Creek stations, said Mr. Dow, to assure synchronism and the exchange of energy necessary for economical system operation. Neither direct linking nor indifferent feeding is employed. Instead there is exchange capacity equivalent to the rating of one large turbine, and the connections can be made between centers of load. Switching facilities are provided so that if more than one turbine goes down in a station a load equivalent to that carried by the additional generators dropping out of service can be disconnected, but this is not done indiscriminately. Furthermore, no network switch, in case of a circuit fault, is required to interrupt the total current that can be supplied by the stations jointly.

Nicholas Stahl referred to some very satisfying experiences of the Narragansett Electric Company of Providence, R. I., with the closed system of generator ventilation in which the heat from the generator is used to raise the temperature of the boiler-feed water. Arrangements are made for converting the system to a straight-through ventilating system when desired or of recirculating the cooling water when all heat cannot be absorbed by the feed water.

P. D. Martin, Philadelphia Electric Company, declared that the cost of alternating-current auxiliary motors with neutrals brought out is only 1 per cent more than the cost of those not so equipped, hence differential control is not more expensive than overload protection and more desirable. He referred to the protection of auxiliary motors in the Philadelphia Electric Company's new Delaware station.

V. E. Alden, Consolidated Gas, Electric Light & Power Company, Baltimore, referred to an instance where an entire station was shut down by losing its electrical connection with a paralleled system because the low-voltage releases on the forced-draft fans tripped out. Recurrence of this trouble will be avoided by the latches which have been put on all low-voltage relays to cut them out during emergencies of this kind. He expressed a decided preference for direct-current drive.

D. L. Galusha, Dwight P. Robinson Company, Inc., referred to a recent experience at Colfax station of the Duquesne Light Company which demonstrated the ability of the auxiliary drive system installed there to maintain service.

A. F. Bang, Pennsylvania Water & Power Company, discussed methods of fighting fires, favoring carbon

tetrachloride for small fires around energized equipment where the poisonous gases emitted will quickly disperse, soda or bromide solutions where the fires are larger but electrical circuits de-energized, and sand or sawdust for still larger fires, but not in oil switches where the conflagration can be covered.

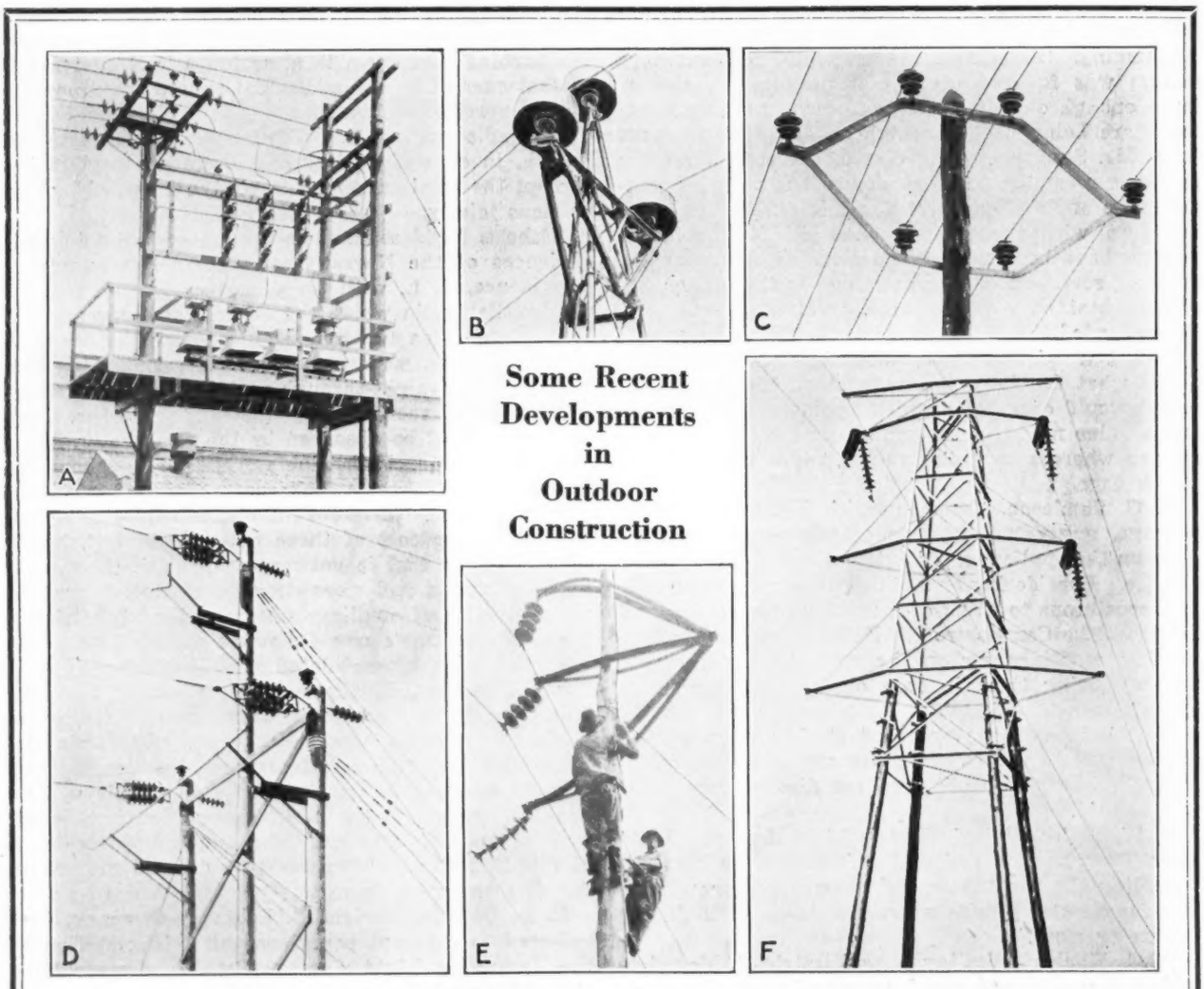
W. L. Abbott, Commonwealth Edison Company; I. M. Stein, R. E. Argersinger and Prof. C. F. Scott, Yale University, also spoke.

Overhead Systems

The collection of data from operating companies regarding present-day practice is the outstanding feature of the report of the overhead systems committee, W. K. Vanderpoel chairman. It includes a study of the value of overhead ground wires, the most desirable pole spacings, conductor arrangements and spacings, relative merits of the delta-connected and star-connected systems, advantages and disadvantages of a grounded system and method of establishing such a ground, merits of loop transmission, insulator testing and related subjects. An intensive study was also made of wood poles with a view to revising the specifications. Although overhead ground wires do afford some protection to insulators, the extent and value of this protection are uncertain. Furthermore, they do not afford any more protection to the poles than individual ground wires on each pole unless grounding conditions are exceptionally poor. However, there is evidence that ground wires do afford protection to station apparatus, but the evidence is not conclusive as to the extent of such protection. Their value in reducing disturbances depends upon type of relays employed, individual ground conditions and other local conditions.

The possibility of controlling flux distribution by means of horns or guard rings was shown by A. O. Austin by means of stereopticon pictures. Insulated horns or rings reduce the tendency to arc over, though in general rings are less effective than horns. The possibility of improving conductor conditions by wire-mesh caging over the conductor was also shown.

Fifteen to twenty-five per cent in investment charges is saved or at least prevented by temperature indicators on distribution transformers, declared L. L. Elden, who also said that these devices enable better loading of transformers than mere estimating of loads.



A—Oxide film arrester installation. B—Hoods on insulators to protect them from dust deposits. C—Double wishbone arms for double-circuit line. D—Wood-pole strain tower for long spans. E—Bow-arrow arms at turn in line. F—Steel tower top supported on wood stilts when steel was difficult to secure.

E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, expressed the sympathetic interest manufacturers feel in this movement. He praised the exhibit of N. E. L. A. publicity material at the convention and urged further vigorous team play.

Underground Systems

Special attention to the importance of correct splice making is called in the report of the underground systems committee, F. E. Ricketts chairman. Records of operating trouble with high-tension cable are said to show that about 37 per cent of the number of breakdowns occur in splices. The most important considerations in making a successful splice are mentioned in the report, the specifications used by one company being given in an appendix. Attention is particularly called to the importance of making a yearly survey of the temperature in crowded duct lines, as the maximum rating depends on the maximum duct temperature prevailing. Experiences of some of the larger companies with "hot spots" in their duct lines are related, and the means they have employed to combat this trouble are given, such as artificial ventilation and sprinkling of the duct lines with water.

Cracking of lead sheathing, said C. H. Shaw, New York, in discussion, is due principally to careless handling and installation. Another cause is crystallization by vibration, according to E. R. Northmore, Los Angeles. D. W. Roper said this trouble was caused by the turns of the cable rubbing against each other during shipment and has been prevented by greasing the cables before reeling. An addition of 2 per cent to 3 per cent of tin in the lead will also alleviate this fault. F. E. Ricketts said that the Baltimore company adds 1 per cent of antimony for the same purposes and secures very good results at a smaller cost.

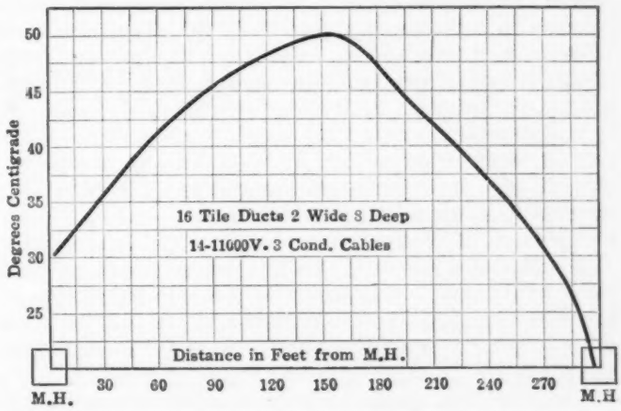
Discussing higher voltages for underground cables, Mr. Roper said that the Commonwealth Edison Company is planning to distribute 33,000 volts over cables which during the last two years have been installed for 22,000 volts. No trouble is expected with the higher voltage. He mentioned a test on some 12,000-volt cable lasting two weeks in which the cable was subjected to 33,000 volts at 100 deg. C., followed by another test of equal duration at 35,000 volts and the same temperature before a breakdown occurred at the end bell. The insulation was $\frac{13}{64}$ in. thick on conductors and $\frac{6}{64}$ in. on the belt. He referred to a 33,000-volt cable in service in England with $\frac{1}{2}$-in. and 0.4-in. insulation respectively.

Use of underground cable in France for 33,000, 48,000 and 60,000 volts was described by Jules Delon, Compagnie Générale des Cables de Lyon. Since 1914 there has been a 30-km. length of 33,000-volt cable in Normandy transmitting 6,000 kw. to 7,000 kw. at 50 cycles three-phase. The cable is armored with steel tape and is buried directly in the ground. The belt insulation is 5.5 mm. thick, and the insulating compound has a mineral-oil base. The maximum working temperature is 50 deg. C. Another three-conductor cable laid in the ground transmits 9,000 kw. of 50-cycle energy at 48,000 volts with an ungrounded neutral. In Paris three single-conductor cables will be laid soon to carry 30,000 kw. at 60,000 volts. The insulation is 15 mm. in thickness.

The joints in the 33,000-volt cables are made every 760 ft. A cast-iron junction box is employed for the three-conductor cables, and the conductors are separated by a porcelain sleeve and compound, no wrapping being done. The 60,000-volt cable has a lead sleeve for the joints, which are filled with compound, and no wrapping is used. The filling compound has the same melting point as the impregnating compound. For risers on the three-phase cables a cast-iron box and porcelain insulator are employed. For the single-conductor cable a copper bell and a porcelain insulator are used.

To eliminate trouble in cable risers, the Commonwealth Edison Company is changing from single-conductor potheads to four-conductor, said Mr. Buck. H. G. Hall said that the Detroit Edison Company is experimenting with single-conductor and three-conductor pothead for 25,000-volt risers.

Mr. Shaw said that on account of the relatively high price of fuel the New York Edison Company has found it economical to install additional cables to reduce the energy loss in cables 30 per cent to 40 per cent. This



HOW TEMPERATURE VARIES ALONG A TYPICAL DUCT RUN

emphasized the fact that there is another factor which should limit cable load besides the common limit which is imposed by destruction of the insulation on overheading.

Discussing instruments for measuring duct temperature, M. I. Stein, Leeds & Northrup Company, stated that the thermocouple serves well for surveys, while the resistance thermometer is better for a station recording instrument.

Meters

Interest in metering applications has centered during the past year on the determination of integrated values of reactive kilovolt-amperes, according to W. L. Wadsworth, chairman of the meter committee. Fourteen methods in use for measuring reactive hours for the purpose of determining power factor were investigated. Other work which was taken up was the detailed course for metermen, which, although not finished, is in such shape that the work may readily be continued and completed. Along the lines of standardization of meter and instrument design, it was recommended that manufacturing companies develop bottom-connected watt-hour meters with separate terminal chambers in ratings up to and including 50 amp., two-wire and three-wire. The standard rotation for meter elements should be in a counter-clockwise direction when observed from above. For demand meters it was the consensus of opinion that scales should be made longer. For single-

phase meters this would be approximately 150 per cent of full-load rating of the meter, such capacity being regarded as volts times amperes; for polyphase meters, 125 per cent to 130 per cent full-load capacity with a tolerance of plus 5 per cent.

DISCUSSION OF METER COMMITTEE'S REPORT

The discussion on the report of the meter committee centered around operating conditions and difficulties. The chairman made it plain that the committee was anxious to receive suggestions along this line on which it might work in the future. Considerable opposition was voiced against dividing the "Metermen's Handbook" into two volumes on its revision. The importance of educating metermen was brought out, and in this connection it was announced that Yale University is to conduct a metermen's course during the summer. Other schools are doing likewise.

Alex Dow, chairman of the rate research committee, emphasized the need for a metering device that could be used in arriving at a just basis for penalizing low-power-factor loads and crediting high-power-factor loads in rate schedules. He showed that a device as accurate as the watt-hour meter was not needed so much as a device that can be used over a wide range of loads and be inexpensive enough to cause it to be freely employed. Mr. Dow expressed the opinion that the utility commissions would approve the use of such a device on the basis of the justice in charging for service which it would make possible. Such a device would be used with an ordinary watt-hour meter, and the ratio of kilowatt-hours to kilovolt-ampere-hours would be used as the factor in establishing the rates for power service where the question of power factor is involved.

The new kva. demand meter recently placed on the market by the Esterline Company was explained by D. J. Angus, the inventor.

Inductive Interference

There is an increasing necessity for the co-ordination of power and communication services using the highways for delivering the various public services to the users, according to the inductive interference committee, A. E. Silver chairman. In the past, with a more scattered demand for these services, the avoiding of inductive interference by separation of facilities has been extensively advocated as a general policy by the communication interests and was for a long time practicable of accomplishment to a varying degree. However, with increasing community concentration the fallacy of believing that superior rights are acquired by prior occupancy of highways must be recognized.

The committee's work during the past year has been primarily the establishing of an engineering department at the association headquarters and a policy of active participation in the situation. A basis has now been laid for co-operation with the telephone companies in the study of inductive interference and its mitigation.

A feature of the inductive interference session was the presence of several representatives of the American Telephone & Telegraph Company. If telephone men could know the corresponding men in the light and power industry with whom they must deal, Bancroft Gherardi asserted, the conflict between the two interests would be far on the road to solution. The two industries must find a fair basis on which to give the two services that the public needs without imposing costs or sacrificing the service of either.

It was announced by R. F. Pack that a committee to classify points of agreement and disagreement had been organized for active work under the joint leadership of Mr. Gherardi and himself. National engineering bodies cannot settle the inductive interference situation alone, said H. L. Wills of Atlanta. Unless there is mutual confidence and help is secured from everybody the move for co-operation must crumble.

Sympathy for the small power companies that are required to face a large telephone organization with every facility at its command was expressed by Donald Henry of the Illinois Public Utilities Commission, who made a plea for a definition of "Substantial Interference."

H. B. Hayden of the Wisconsin Railroad Commission emphasized the difficulties of commissions due to lack of funds and forces to carry on research necessary in telephone interference cases. The speakers just named and A. B. Campbell of the Iowa Commission, A. E. Knowlton of Connecticut and E. H. Morse of North Dakota made pleas for co-operation. The real problem in bringing about co-operation, declared Peter Junkersfeld, is one of educating the men of both industries. W. J. Canada warned against hasty decisions and ill-balanced action.

TRIBUTE TO THE LATE DR. E. B. ROSA

Out of respect to the memory of the late Dr. E. P. Rosa, chief physicist of the National Bureau of Standards, who gave such earnest and conscientious support to the furtherance of safety measures in this country, the committee on safety rules submitted its report by title only and presented the following resolution, which was accepted unanimously:

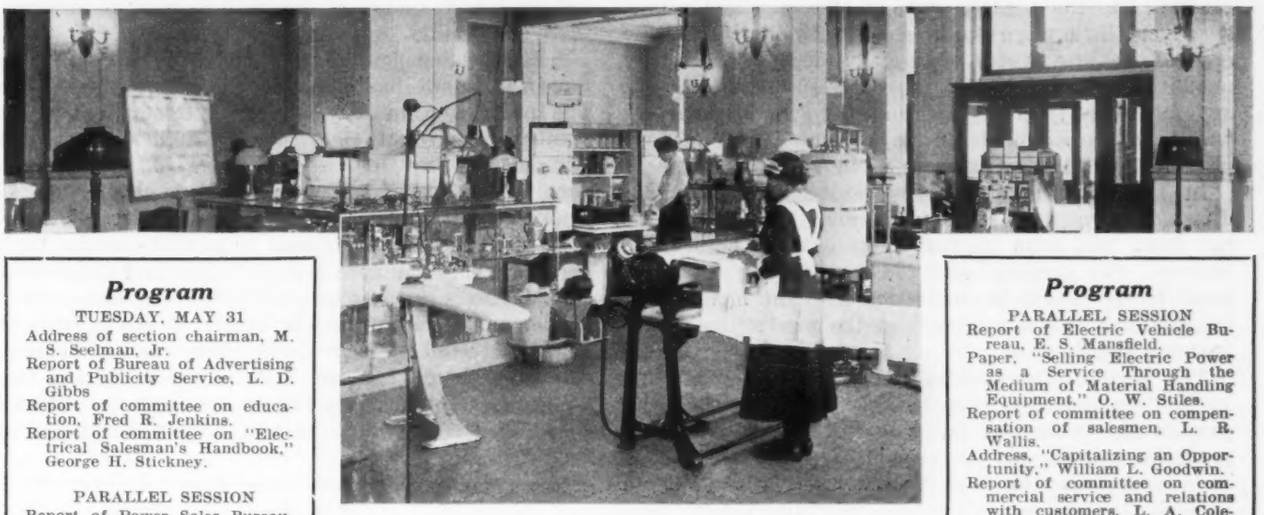
Whereas the executive committee of the Technical National Section of the National Electric Light Association has learned with profound regret of the death of Dr. Edward Bennett Rosa, chief physicist of the United States Bureau of Standards and long closely associated with the development of the National Electrical Safety Code; and

Whereas this committee desires to place on record its high appreciation of the public service of this distinguished physicist and research engineer, who brought to his work and to public relations the highest ideals of personal devotion, public duty and loyalty to principle, attaining unusual success; and

Whereas in the discharge of every duty and responsibility Dr. Rosa's steadfast qualities of mind and character won the respect and esteem of all with whom he came in contact, and at the time of his death he was meeting increasing appreciation of his accomplishments, it is, therefore,

Resolved, that the committee express its acknowledgment of the disinterested work done for the industry by Dr. Rosa, and that this resolution be spread in full on the minutes of the committee and be transmitted by the secretary to the family of Dr. Rosa and to the director of the Bureau of Standards.

R. F. Schuchardt, W. J. Canada and W. C. L. Eglin testified to their appreciation of Dr. Rosa's work. Mr. Eglin expressed the highest personal regard for Dr. Rosa's integrity, high sense of honor and keen sense of duty. Mr. Canada said that it had been his great pleasure to work with Dr. Rosa and that he could testify to the earnest aims, deep thought and constant search for truth that characterized Dr. Rosa's efforts. The co-operation which existed between the Bureau of Standards and those affected by its work must be continued, he said.



Program

TUESDAY, MAY 31

Address of section chairman, M. S. Seelman, Jr.
Report of Bureau of Advertising and Publicity Service, L. D. Gibbs
Report of committee on education, Fred R. Jenkins.
Report of committee on "Electrical Salesman's Handbook," George H. Stickney.

PARALLEL SESSION

Report of Power Sales Bureau, H. H. Holding.
Report of division on economics of the use of central-station electric power, J. W. Meyer.
Report of division on industrial electric heating, N. T. Wilcox.
Report of division on electric arc steel furnaces, Joseph McKinley.
Report of division on general power, George H. Jones.

WEDNESDAY, JUNE 1

Report of Merchandise Sales Bureau, Dorsey R. Smith.
Report of division on electrical merchandise, C. E. Greenwood.
Report of division on electric shop management, Thomas Berger.
Report of division on standardizing and testing, R. S. Hale.
Report of electric range division, C. O. Dunten.

Commercial Sessions

CONSTRUCTIVE discussion of commercial and merchandising problems marked the commercial sessions of the convention this year. The advertising and publicity as conducted during the past will be continued with a broadening aspect, as it was felt that this service has fully proved its value to the industry. General conditions in the merchandising field, while passing through the inevitable period of readjustment, are gradually improving and a distinct note of optimism was prevalent.

Tremendous future loads will be built from industrial heating. The electrical vehicle, pumping and electrolytic processes, new developments and increased activity in industrial lighting offer a profitable field for additional revenue.

Program

PARALLEL SESSION

Report of Electric Vehicle Bureau, E. S. Mansfield.
Paper, "Selling Electric Power as a Service Through the Medium of Material Handling Equipment," O. W. Stiles.
Report of committee on compensation of salesmen, L. R. Wallis.
Address, "Capitalizing an Opportunity," William L. Goodwin.
Report of committee on commercial service and relations with customers, L. A. Coleman.

THURSDAY, JUNE 2

Report of Lighting Sales Bureau, Oliver R. Hogue.
Report of committee on educational exhibits, Clarence L. Law.
Report of division on residence lighting, M. Luckiesh.
Report of division on street and highway lighting, W. D'A. Ryan.
Report of division on industrial lighting, G. Bertram Regar.
Report of division on lighting of large buildings, F. A. Gallagher.
Report of division on commercial aspects of lamp equipment, Earl A. Anderson.
Report of division on sign, display and billboard lighting, H. I. Markham.
Report of division on store lighting, James J. Kirk.

Merchandising

Four divisions make up the report of the Merchandise Sales Bureau, Dorsey R. Smith chairman—electrical merchandising, electric ranges, electric shop management, and standardization and testing.

Pointing out that the merchandising departments of central-station companies can be made an invaluable help to the utilities as a connecting link between the company and the public, the bureau stated that every effort should be made to develop central-station merchandising business. The electric light and power companies should be the leaders in this field and at the same time should keep in close touch with the large number of electric specialty shops coming into existence in order to maintain a high standard of service and to protect customers from inferior appliances.

Outlining the principal subjects for consideration in operating the merchandising department, the electrical merchandising division, C. E. Greenwood chairman, said that the success of an electric shop is dependent chiefly on the choice of merchandise, and it is of primary importance that the "service" in an appliance be the basis of the selection.

It was the belief of the division that the central-station shop should sell portable lamps, if not fixtures. With regard to the sale of "side lines" of merchandise the committee felt that if an electric shop could not do a profitable business on electrical merchandise only, the trade is laboring under a serious handicap; however, if profit or loss depends on kindred merchandise, it ought to be sold.

An adequate system for determining the cost of doing a merchandising business is essential to success, and the division strongly advocated the adoption of an accounting system which would give the true selling costs and recommended the classification prepared by the Accounting Section last year.

Growth of the electric range load during the last four years has been quite rapid, but not so rapid as the lucrativeness of the business warrants, and the report of the electric range division, C. O. Dunten chairman, was devoted mainly to collecting authentic information as to new investment required, increases in operating expenses, income and other data. The field for electric ranges, in the opinion of the division, is especially attractive to the electric light and power company, but has not received the attention that it deserves as many companies have erroneous ideas of this branch of the business. To facilitate analyzing the conditions affecting the electric range business the division has prepared and included in its report a comprehensive formula for determining the profitableness of the electric range load to the central station.

The present electric water-heating devices have been

developed to the highest state of efficiency and apparently very little more can be done. The question of the cost of heating water electrically depends primarily upon the rate for electricity which is in effect. In general, where the rate is 3 cents per kilowatt-hour hot water may be supplied for the average family of four people at a cost varying from $5 to $8 per month.

In the opinion of the electric shop management division, Thomas W. Berger chairman, too much stress has been laid upon clerical routine work before the business was secured, and too much study has been given to the details in connection with the handling of the business and not enough to the production of the business itself.

The work of the standardizing and testing bureau, R. S. Hale chairman, has been confined for the most part to the testing of flatirons and heater cords. A preliminary report of the results of these tests, which were very exacting and thorough, is given in an appendix to the division's report. The division will continue these tests and is planning next to take up toasters and heating pads. It is working on the question of what tests should be applied to these.

Discussion of electrical merchandising by central-station companies centered around present practices and the future outlook. J. F. Killeen spoke optimistically of prospective business and pointed out that lower prices depend upon increased production on the part of the manufacturers in order that present overhead cost may be spread over a larger output. Co-operation with the central-station companies, price maintenance and the sale of standard devices were advocated by Sidney Blumenthal, who also believes that sales cannot be materially increased by price-cutting competition.

That central-station men are not the best of merchandisers was the opinion of F. J. Allen, who suggested that all members of electric light and power companies should give a trial to every electrical device which the company has for sale in order that he may be properly informed upon the merits of the appliance. Carrying of more than one make of any particular appliance should be discouraged, according to T. J. Casey, on the ground that no salesman can do justice to two competitive appliances on the same floor. H. H. Newman differed from this view, believing that customers should have choice of more than one appliance.

Electrical merchandising, said Walter Fagan, should be conducted along the fundamental principles of general merchandising, and technical atmosphere should be eliminated from the electric shops and stores wherever possible. Growth of income from the sale of merchandise by central-station companies is best shown, H. N. McConnell asserted, by an instance of one company whose income from this source is equal to the gross income from the sale of energy to its residential consumers. He deplored the fact that the salesrooms of many companies lack the equipment conducive to the best results and recommended a careful study of department-store methods.

It is not the purpose of the standardizing and testing division, according to R. S. Hale, to stand as judge and jury on what appliances a company should purchase. It has been the aim of this division to determine which are good and which are poor appliances and then leave the buyer to decide for himself in the light of the knowledge thus elicited. With the services of this division now available, it will be possible for a company purchasing appliances merely to ask a manufacturer of such devices for the results of the tests in order to determine their desirability.

J. F. Farquhar pointed out that the Washington Water Power Company has 3,000 electric ranges on its lines. The proportion in the suburbs (22 per cent of the number of accounts is relatively higher than in the city. There are 2,400 water heaters so connected that simultaneous use of heater and range cannot occur. The net revenue per kilowatt-year of demand for this load is $66. This allows for interest on capital charges (at 15 per cent), maintenance and operation and construction cost making a gross revenue of $84.50 per kilowatt-year on demand. The demand is figured at one-seventh the connected load of each range, and one heater has a connected load of about 7 kw. Therefore the foregoing figures will apply to one such set as well as to 1 kw. of demand, and one set will net about $66 per year.

Lighting

A change in the activities of the Lighting Sales Bureau during the past year in order to make its aims and scope more specific was dwelt on in the report of the bureau, Oliver R. Hogue chairman. Its work was planned with the following objectives in mind: To promote appreciation of the value of lighting to the electrical industry, to collect, analyze and disseminate information concerning lighting practice and to promote lighting sales. The bureau operated in seven divisions as follows: (1) Commercial aspects of lamp equipment; (2) industrial lighting; (3) lighting of large buildings; (4) residence lighting; (5) sign display and billboard lighting; (6) store lighting; (7) street and highway lighting.

Attention was called by the lamp equipment committee, Earl A. Anderson chairman, to the movement toward higher standards of lighting both as to intensity and quality and the redesigning of fixtures in the direction of less glare, ease of maintenance and cleaning and better general appearance. The report covers the trend of development in equipment design, which has important influence on lighting practice. Sections of the report were devoted to commercial and industrial equipment, color equipment for show-window lighting, residence lighting equipment, motion-picture lamp equipment and street and outdoor lighting.

Special emphasis was given by the large buildings division, of which F. A. Gallagher, Jr., was chairman, to the duty of the central-station company to work for good lighting in large buildings.

The advantage of good lighting to the employer and the employee was emphasized in the report of the division on industrial lighting, G. Bertram Regar chairman. Included were curves showing the increased cost of living contrasted with the decreased cost of electric lighting, "before and after" pictures of lighting installations, accident curves and production curves.

This year's report of the residence lighting division, M. Luckiesh chairman, included data pertinent to and showed the possibilities inherent in residence lighting. Wiring specifications for an adequately wired residence were also included. Suggestions were made as to the methods of interesting the householders in the importance of better lighting. Attention was called to the necessity of a campaign to show the physical aspect of lighting and the necessity for redesigning the lighting

fixture for the high-efficiency gas-filled lamps. The division emphasized the opportunity that the central-station company has to see that model homes of house-furnishing and department stores use properly designed lighting equipment.

In the report of the division on sign, display and billboard lighting, H. I. Markham chairman, attention was called to the large revenue that this type of business will produce. A section on billboard and outdoor advertising was included, and allusion was made to a notable development in the increasing use of higher-wattage and gas-filled lamps for electric sign service.

W. D'A. Ryan, in the report of the street and highway lighting division, called attention to the strides that high-intensity street lighting has taken in the past year —the development of a 2,500-c.p. series tungsten lamp for "super-whiteway" lighting and the improvements in electrodes for luminous-arc lamps.

A forceful presentation of the present deplorable conditions of commercial lighting was given in the report of the store lighting division, of which James J. Kirk was chairman.

The report of the education exhibit committee of the lighting department, which was newly created this year for the express purpose of promoting industrial lighting exhibits, embodied a résumé of the demonstrations conducted. There are now eight exhibits in full operation, three are under construction, and four cities are about to put on exhibits. In addition to his report of the activities in the establishment of permanent lighting demonstrations, Field Director Ward Harrison included as an appendix a lecture on industrial lighting.

Electric Vehicles

In view of the fact that the Post Office Department has authorized an expenditure of $50,000 to conduct an investigation into the use of electric trucks for that branch of the federal government, the Electric Vehicle Bureau's comparative data committee, F. M. Feiker chairman, decided to postpone for the present its work of getting together statistics on the cost of operation of electric vehicles as compared with the cost of operation of other forms of trucking and recommended that the actual work of starting the investigation be delayed until after the issuance of the postal report.

The activities of the electric vehicle exhibition com-

L. D. GIBBS
Superintendent Advertising Dept.
Edison Electric Illuminating Company

H. H. HOLDING
General Power Representative
Public Service Electric Company

D. R. SMITH
Manager Merchandise and Domestic Sales
Consolidated Gas, Electric Light & Power Company

E. S. MANSFIELD
Supt Field Statistics
Edison Electric Illuminating Company

O. R. HOGUE
Head Lighting Agent
Commonwealth Edison Company

L. A. COLEMAN
Treasurer United E'ectric Light & Power Company

L. R. WALLIS
Superintendent Sales Dept.
Edison Electric Illuminating Company

C. L. LAW
Manager of Bureau of Illuminating Engineering
New York Edison Company

Chairmen of commercial committees who presented reports at the Chicago convention: Mr. Gibbs, Bureau Advertising and Publicity Service; Mr. Holding, Power Sales Bureau; Mr. Smith, Merchandise Sales Bureau; Mr. Mansfield, Electric Vehicle Bureau; Mr. Hogue, Lighting Sales Bureau; Mr. Coleman, committee on commercial service and relations with customers; Mr. Wallis, committee on compensation of salesmen; Mr. Law, committee on educational exhibits, which are effective in improving lighting.

mittee, of which Charles R. Skinner was chairman, has resulted in two successful exhibitions of electric vehicles since Jan. 1 of this year. One was held in the showroom of the New York Edison Company and the other was held by the Public Service Corporation of New Jersey at its Newark showroom, where all the vehicle manufacturers were represented. The committee reported that twenty-two exhibitors had signified their intention of exhibiting at the electric automobile show in the electric shop of the Commonwealth Edison Company from May 26 to June 4 at the time of the N. E. L. A. convention. Exhibitions are under consideration in Boston and other large cities.

A report is now in process of compilation by the committee which will set forth in detail figures concerning the cost of these garages, and the belief was expressed that there is no reason why capital should not enter the electric garage field.

No laws adverse to the electric vehicle were passed during the year 1920-21, according to Day Baker, chairman of the legislation committee. However, a number of motor-vehicle bills were before committees of various legislatures. Details of the action taken will be reported later by the committee.

Progress in the use of electric trucks has been gradual, indicating that its application is being made on a firm and sound basis of merit and of advantage to the user. The transportation engineering committee, F. M. Feiker chairman, reports that during the past year more electric trucks were sold in New York City than ever before. This is taken as an indication of renewed interest on the part of users in the inherent economy of the electric truck as a method of local delivery.

C. R. Skinner, rates sub-committee, announced that rates on battery charging are being collected and that attempts will be made to obtain preferential rates for such business.

In a paper on "Selling Electric Power as a Service Through the Medium of Material-Handling Equipment," O. W. Stiles, manager industrial transportation of the Lakewood Engineering Company, presented a number of interesting examples of the savings effected in industrial plants by the installation of material-handling machinery.

Compensation of Salesmen

To ascertain the conditions obtaining during the year the committee on compensation of salesmen, L. R. Wallis chairman, sent a questionnaire to ninety-nine company members serving populations of 100,000 or more. Of the thirty-eight companies from which answers were received, fifty-two pay weekly or monthly salaries with no commission for salesmen selling service. Seventeen companies, however, favor paying on a salary and commission basis, and fifteen oppose paying any commissions. Twenty-six of the companies reporting pay salary for salesmen selling appliances, and one pays commission only on such sales. Payment of commissions based on the gross amount of appliance sales in addition to the regular salary was favored by twenty-two companies, while five opposed such commission, favoring straight salaries only. Commissions paid to appliance salesmen were found to vary from 1 per cent to 20 per cent on gross sales, one company paying on a basis of 50 per cent of the gross profit.

M. S. Seelman, chairman of the Commercial Section, called attention to the tendencies of central-station companies to pay their salesmen a commission for business that is particularly profitable.

O. R. Hogue, Commonwealth Edison Company, gave some very interesting experiences of his company in compensating salesmen. He pointed out that the central-station salesmen function in two capacities, namely, first as stimulators of public good will and second as salesmen. Therefore salesmen should be compensated primarily for maintaining good will. During the war, owing to the lack of generating capacity, central stations had to stimulate business which would fill the valleys of their load curves. As a result they had to set values on different kinds of business. Now they believe that salesmen should be paid on the basis of what income the business brings per kilowatt-hour.

It was urged by Frank D. Fagan, Edison Storage Battery Company, that members advise the committee of all legislation accomplished or contemplated in different localities which will affect the status of electric vehicles.

Publicity

The problem today is not so much one of organization and sales promotion as to find ways and means of meeting capital requirements, said William L. Goodwin, assistant to the president of the Society for Electrical Development, in his address. The big work of the future is to eliminate waste and work. It is estimated that the human effort wasted in convention and association activities, chiefly through duplication of efforts, would amount to from $10,000,000 to $15,000,000 annually if it could be reduced to a monetary basis. Besides duplication there is also the danger, as the associations grow larger, that some bodies will work against the interests of others or of the whole industry.

Another object will be to "sell" the electrical industry to the men associated with it. Although the number of electrical men who have investments in the industry is increasing, it is still a small percentage of the total number in the industry.

Another suggestion along financial lines was the formation of a body to handle the time payments of the installment business of the industry. This may amount to three, four or even ten billion dollars annually. Another need which will be cared for is the insufficiency of trained men for the merchandising end of the industry. The society will attempt to induce colleges to establish courses to train such men and will conduct a correspondence school for the same purpose. Regional, national and local committees will be established, as well as specialized committees, to lay out plans as to how best to further the interests of the industry.

Relations with Customers

During the past year members of the committee on commercial service and relations with customers, L. A. Coleman chairman, have tried to bring before executives and employees various phases of this work through articles in the *N. E. L. A. Bulletin.* A series of pictorial pamphlets showing how customers are affected by good and by bad service are planned, and the first set, the report states, wil be ready in a few weeks. These pamphlets are to be followed with suggestions in connection with billing, collecting methods, handling complaints, etc.

"The employee should be so educated," the committee

said, "that he will feel the responsibility which is his when dealing with the customers, and the executives should be shown that red tape, antiquated systems of application routine, drastic and imperious collection methods, inaccurate billing and inattention and lack of courtesy in handling complaints are the chief causes of disagreement."

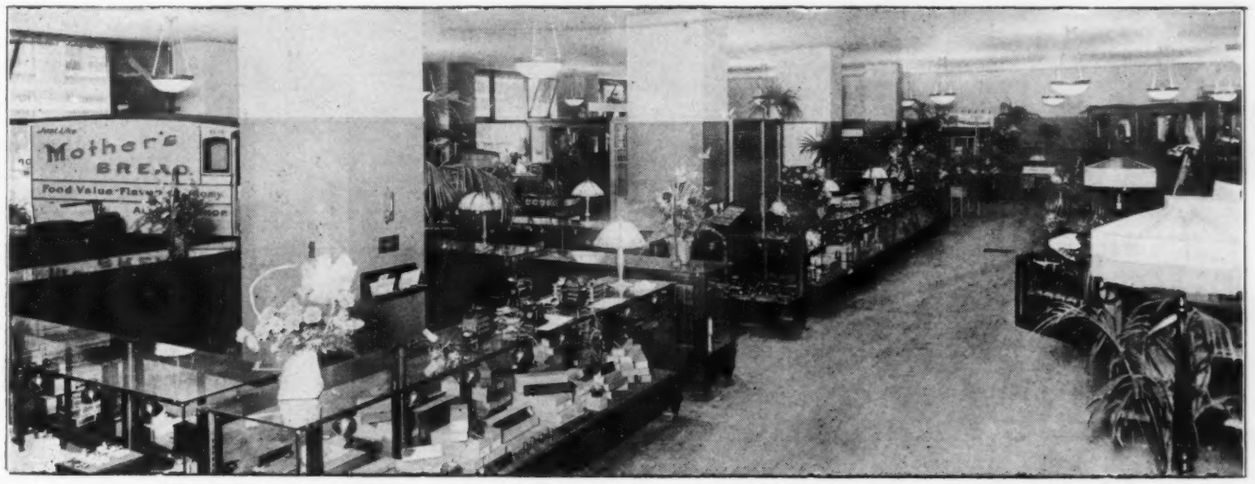
The national good-will campaign conducted from headquarters has had, according to the report of the Advertising and Publicity Service Bureau of the Commercial Section, L. D. Gibbs chairman, the hearty support of every advertiisng man in its field. The work has included the handling of pamphlets prepared by Director of Publicity Oxley and helping to conduct the national co-operative advertising campaign. The bureau's various divisions reported separately.

The division on adequate outlets and co-ordinate advertising, P. L. Thomson chairman, reported that during the year it had continued to draw the manufacturers' attention to cases in their advertising where electric outlets in the wall were overlooked and connections to appliances represented as if made from lighting articles and to continuing the experiment of supplying syndicate material to electrical pages of newspapers.

The publication division, Cyril Nast chairman, reported against getting out any considerable new printed matter until that now on hand shall be disposed of. Owing to the business depression last year's publications did not sell so well as had been hoped, and more than half the booklets and folders printed were still on hand on May 7.

In a short address at the opening of the meeting J. F. Madison, president of the American Association of Advertising Agencies, quoted some interesting data on results of recent surveys of the business done by different electrical dealers. According to Mr. Madison, a comparison of fifteen advertising dealers with fifteen non-advertising dealers showed that the advertising dealers did more than six times the amount of business done by the non-advertisers and their sales per thousand population were in virtually the same ratio.

William L. Goodwin, in offering the services and cooperation of the Society for Electrical Development on matters pertaining to advertising and publicity, made



VIEW OF COMMONWEALTH EDISON COMPANY'S ELECTRIC SHOP, WHERE THE ELECTRIC VEHICLE SHOW WAS HELD DURING THE N. E. A. L. CONVENTION

sockets. Four manufacturing companies have published booklets on the completely electrified home. The calendar assigning special commodity sales to each month in the year as adopted in former years was indorsed without change.

The division of illuminating engineering (non-technical lighting applications), P. B. Zimmerman chairman, which represents primarily the advertising specialists of manufacturers and central station companies particularly interested in promoting better lighting and extending its field, reported that it had endeavored successfully to arouse interest in the N. E. L. A. industrial lighting exhibits and spoke of the popularity of some of its informative publications.

The division on newspaper advertising campaigns, Norman Maul chairman, devoted its efforts principally to finding a way to increase the use of electrical page newspaper advertising. It felt that the fact that electrical pages are not more extensively used was due to the indifference of the electrical interests involved and not to any shortcomings in the idea itself.

The division on news syndicate and magazine writers, Frank B. Rae, Jr., chairman, confined its efforts mainly to organizing a photographic bureau to which writers may apply for acceptable pictures to illustrate their a plea for a uniform adoption in advertising of elementary terms which can be easily understood by the householder and layman.

EDUCATION

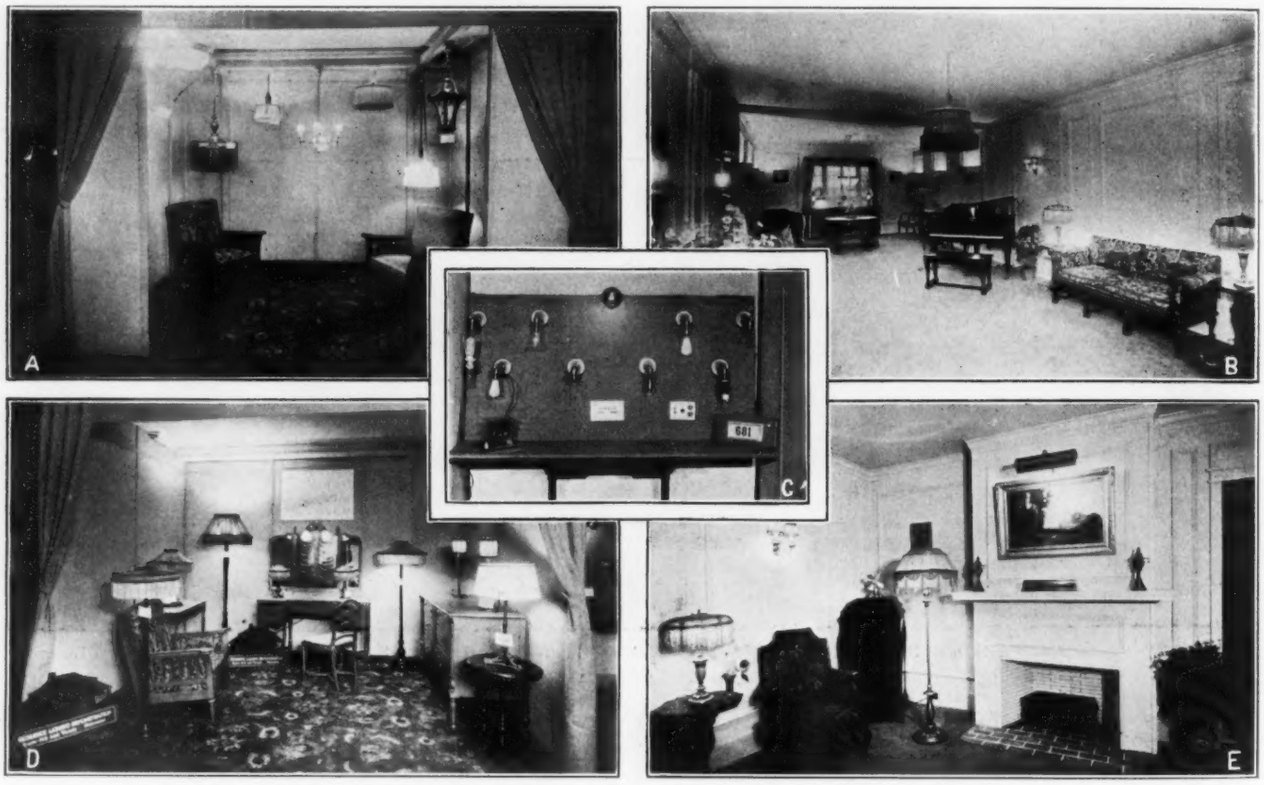
Two courses, one in commercial engineering and the other in practical electricity, the former started in November, 1915, and the latter in January, 1917, have been continued by the education committee, of which Fred R. Jenkins is chairman. Considerable publicity has been given to these courses during the year. Both courses have continued to be self-supporting, with sufficient surplus to allow for future reprinting, revising and constructing of courses. The committee recommends that next year an additional course be started which would be a combination of the subjects covered by the present courses with desired additional matter so as more generally to cover the requirements of all classes of members.

This year the "Electrical Salesman's Handbook" committee, G. H. Stickney chairman, planned to resume publication of the handbook, and material is therefore being collected under the following sections: "Power," "Industrial Heating," "Lighting," "Electric Vehicles," "Domestic Heating and Appliances," "Wiring" and

"The Salesman and His Work." Two books, one "Industrial Lighting" and the other "Lamp Equipment for Commercial and Industrial Lighting," are now on sale and will be considered a test of the efficiency of the plan adopted for selling the handbook.

Industrial Load

Manufacturers are tending to consider the element of power cost from the viewpoint of cost per unit of product rather than cost per unit of power. With this in mind, the Power Sales Bureau, H. H. Holding chairman, has given particular consideration this year to electric heating, steel furnaces, economies in the use of central-station power and the general diversification of load. Special attention has also been given by the sub-committee on the economics of the use of central-station electric power, J. W. Meyer chairman, to the cost committee on the economies of the use of central-station service and to methods of increasing loads.



RESIDENCE LIGHTING DEMONSTRATION AT CONVENTION

A—Tendency in fixture design. B—Lighting for large living room. C—Special sockets and convenient plug devices and lamps. D—Specially designed portables for houses. E—Mantel, indirect portable and double bracket lighting, which allows variety.

Glass annealing, normalizing of castings and wire, oil tempering, automatic arc welding, non-ferrous metal melting, bread baking and the electrically heated steam boiler are some of the most interesting developments of the past year, according to the sub-committee on new developments in industrial electric heating, N. T. Wilcox chairman. The outlook for increasingly large and profitable power loads from such applications is most encouraging, the committee held, and should be carefully studied by all live sales organizations.

In steel making, excellence of product is the only factor controlling the use of electrical energy, the sub-committee on electric arc steel furnaces, J. McKinley chairman, asserted.

Electric water pumping as an auxiliary to existing pumping plants was shown to be practicable on a very large scale by the sub-committee on general power, G. H. Jones chairman. Because of the diversity factor electrochemical processes offer a good field for power development.

Alex Dow, president Detroit Edison Company, in commenting on the acquisition of new business, pointed out that at the present time the cost of capital necessary for plant extension is the controlling factor. He warned against a central station investing too much capital to supply only one industry which might later suffer serious depression. In speaking of special rates (off-peak rates, etc.) he advised that they should be as nearly as possible consistent with the regular rates. That the rates for power should be removed from the jurisdiction of public service commissions was advocated by Morse Dell Plain, Northern Indiana Gas & Electric Company, Hammond, Ind. He contended that energy for power is a competitive product and that rates should be determined in the same way as the cost of other commodities.

G. E. Miller, Cleveland Electric Illuminating Company, objected to the off-peak rate schedule shown by Mr. Meyer, contending that it gives a consumer a rate even at the times of peak load which is less than the standard rate to regular customers.

Speaking of industrial heating, V. M. F. Tallman of Charles H. Tenney & Company, Boston, told of the good results which had been secured from an educational course conducted by the New England Division.

Accounting Sessions

Reports of Committees Recommend a More Intensive Study of Accounting and Financial Problems

PROBLEMS that are most vital to the existence of central stations were taken up by the Accounting National Section in its three afternoon sessions. Subjects such as credits, collections, bonus systems, classification of accounts and other equally important features brought forth thorough discussion. It was suggested that committees to be appointed give careful study to the question of income-tax procedure and to the comparative costs of mechanical and hand billing. Both subjects provoked lengthy discussion and a considerable divergence of opinion.

Program

TUESDAY, MAY 31

Address of section chairman, J. C. Van Duyne.

Report of committee on accounting education, Fred R. Jenkins.

Report of committee on classification of accounts, reports to commissions and relations with other associations, W. J. Meyers.

Report of committee on purchasing and storeroom accounting, W. F. Stevens.

WEDNESDAY, JUNE 1

Report of committee on federal income-tax procedure, F. B. Odlum.

Paper, "Accounting for Coal," H. M. Edwards.

Report of committee on customers' records and billing methods, J. D. Jacobus.

Report of committee on credits and collections, David Darlington.

THURSDAY, JUNE 2

Report of committee on bonus systems, A. H. S. Cantlin.

Report of committee on security holders' records, William S. Kline.

Report of committee on investment budget control, Harry A. Snow.

Uniform Classification

Under the present high cost of capital the necessity for a comprehensive budget system has been realized by central-station companies, according to the report of the committee on investment budget control, Harry A. Snow chairman. Budget systems may be divided into three classes, (1) Construction, which should provide for future needs of a company over a given period and which should also include an analysis of the problems in such form as can be laid before executives; (2) operation, which should embrace a forecast of interest and dividend payments to be met, fuel requirements, increased load, probable profits and the estimated cost of departmental operations; (3) material and supplies, which should tend to make it impossible to run up an excessive investment in stock, thus tying up capital.

Large companies, said H. M. Edwards of the New York Edison Company, have reached the point where it is impossible to operate without a system of budget control, especially for new construction. He stated that a certain degree of elasticity could be provided in a budget by classifying proposed construction as imperative, urgent or desirable.

H. C. Joy of the Midwest Utilities Company said that the keeping of a diary by the engineering department covering extraordinary conditions under which construction work had been done had been found extremely useful in substantiating costs in valuation proceedings before the Public Utilities Commission.

A short statement was made by the committee on classification of accounts, reports to commissions and relations with other associations, W. J. Meyers chairman, to the effect that: co-operated with the American Gas Association and the National Association of Railway and Utility Commissioners in the development of a standard classification of accounts recommended by the latter association at its annual meeting last November.

Differences in company conditions, said H. M. Edwards, New York, do not justify diversities of practice in accounting. He characterized the new classification as "sound, safe and sane," and said that no regulatory matter should be incorporated in a classification *per se*. John W. Lieb, New York, also commended the work. In the discussion it was brought out that better provision for retirement at first cost of property is made through the reserve account in the new classification, renewals being met out of capital account. It was pointed out that as a rule commissions do not exercise as close control over surplus as over charges to operating account. H. W. Brundage, American Gas Association, also commended the new classification.

Fred R. Jenkins, chairman, then presented the report of the committee on accounting education.

A short statement was made by the committee on federal income tax procedure, F. B. Odlum chairman, in which the duties of the committee are outlined and recommendations made. The committee considers that the subject of federal taxation is of the highest degree of importance at this time and will continue to be for some years to come.

Discussion led to the unanimous conclusion that federal income taxes should be chargeable to operating expenses and not to surplus earnings.

Purchasing

Business conditions call for greater care in controlling the investment tied up in storeroom material and supplies, according to the report of the purchasing and storeroom accounting committee, of which W. F. Stevens is chairman. The falling market, uncertainty of expansion plans and the tendency of manufacturers to reduce stocks call for greater care in stocking the storeroom. Good results are reported where stock control has been put in the hands of a competent committee.

Commenting on the report, C. E. Olwine, Newark, N. J., emphasized the desirability of adjusting claims through the auditor in cases where a large number of storerooms are located over an extended area.

Customers' Records

This year's report of the committee on customers' records and billing methods, J. D. Jacobus chairman, the activities of which extend over a period of five years, covered methods in use by various companies in reading meters, prevention of curbstone readings, reading of skip meters and methods used to insure billing of all meters in service. In the opinion of the committee a close study should be made to insure member companies having a system whereby all meters in service will be billed as it is an easy matter for a customer's record to become lost if not properly safeguarded.

The report of the committee on credits and collections, David Darlington chairman, was originally scheduled to be presented at this session, but was postponed.

The discussion brought out much divergence of opinion on the question of requiring a deposit from residence and small-power customers.

Use of the addressograph machine in preparing dividend checks to effect a saving in clerical work and the signing of checks by the cashier or assistant cashier only, instead of the earlier practice of having two of the higher officers sign, were practices suggested by W. S. Kline, chairman of the committee on security holders' records.

Miscellaneous

The investigation of the use of bonus systems by the bonus system committee, A. H. S. Cantlin chairman, covered 141 companies, serving all cities with a population in excess of 50,000. The returns received indicated that the use of such systems is stationary, if not on the decrease. The committee report gave a brief description of the plan adopted by the solitary member company which has whole-heartedly adopted a bonus plan of payment as an essential feature of its relations with its employees. Letters from the chief executives of some of the large member companies are included in the appendage and bear out the belief of the committee that straight daily and monthly wages will continue in general use by the electric light and power industry.

A method for keeping purchasing department, auditor and station or storage coal records was described in detail and illustrated with record forms by H. M. Edwards, auditor New York Edison Company, in a paper entitled "Accounting for Coal." By means of the system described, the author holds, it is possible to keep an accurate record of all coal from the time it is purchased to the time it is put into the company's bins.

Two courses, one an elementary course and the other an advanced course, have been developed and printed by the accounting education committee, Fred R. Jenkins chairman, and the report this year was a brief statement of the subscriptions so far and the expense of the course and income therefrom. Some notes on the publicity that has been given to the courses and an outline of each of the courses were included.

Criticism of the practice of allowing inadequately prepared employees to take the advanced course was voiced by several speakers.

E. J. Fowler, Chicago, was elected chairman of the Accounting National Section.

DAVID DARLINGTON
Assistant Treasurer
New York Edison Co.

W. S. KLINE
Assistant Secretary
Commonwealth Edison Co.

H. A. SNOW
Statistician
Detroit Edison Co.

A. H. S. CANTLIN
Division Manager
Pennsylvania Power & Light Co.

W. J. MEYERS
Secretary
The United Electric Light & Power Co.

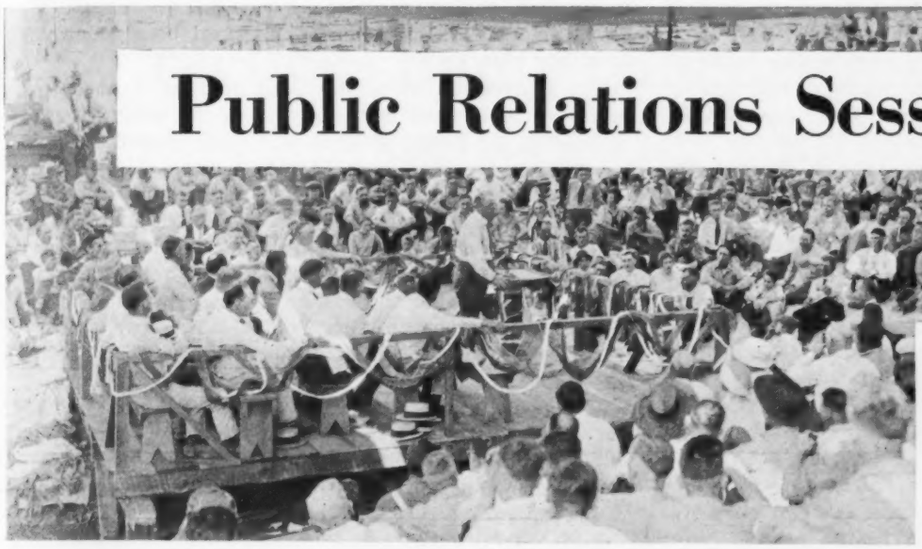
W. F. STEVENS
Supt. Supply Dept.
Edison Electric Illuminating Co. of Boston

F. B. ODLUM
Attorney
Electric Bond and Share Co.

J. D. JACOBUS
Chief Clerk Customers' Accts.
Detroit Edison Co.

Chairmen of accounting committees who presented reports at Chicago convention: Mr. Darlington, committee on credits and collections; Mr. Kline, committee on security holders' records; Mr. Snow, committee on investment budget control; Mr. Cantlin, accounting section, committee on bonus systems; Mr. Meyers, committee on classification of accounts, reports to commissions and relations with other associations; Mr. Stevens, committee on purchasing and storeroom accounting; Mr. Odlum, committee on federal income-tax procedure; Mr. Jacobus, committee on customers' records and billing methods.

Public Relations Sessions



A Demonstration of Public Interest in Electrical Affairs When They Are Conducted on a Partnership Basis. Photo at Official Opening of a Large Western Water-Power Plant

Program

WEDNESDAY, JUNE 1

Address of chairman, J. E. Davidson.
Report of committee on manufacturers' advertising, P. L. Thomson.
Report of committee on public utility information, John F. Gilchrist.
Report of committee on public utility taxation and uniformity of regulatory laws, W. W. Freeman.
Address, "Do We Know Our Customers?" Edward N. Hurley.
Report of committee on relations with bankers, M. S. Sloan.
Report of committee on relations with regulatory bodies, R. H. Ballard.
Report of committee on upbuilding the industry, F. R. Coates.

THURSDAY, JUNE 2
(With music)

Report of public policy committee, Sidney Z. Mitchell.

STEADY improvement in public relations was emphasized at the session devoted to this important subject and presided over by Chairman J. E. Davidson, the open-door policy of the utilities being held in large measure responsible. The meeting was virtually a symposium on the best methods of winning friends with the public, and it came to a climax in the address of Edward N. Hurley, former chairman of the United States Shipping Board, on "Do We Know Our Customers?"

Opening the session, Chairman Davidson reviewed the public information committee work which has now been developed in ten states and is in prospect for the six New England states and others. He advocated more vigorous efforts to acquaint residence lighting customers with the modern equipment now available and recommended that a week be set aside during which central-station men the country over shall address local organizations of business men upon public utility affairs.

Publicity

The work of the public utility information committee warrants the attention of the best minds in the industry, said J. F. Gilchrist, chairman of the committee. The work of the past year in Illinois was described, emphasis being laid upon the value of the weekly news bulletins sent out from the local headquarters. Much editorial comment has been voluntarily published in local papers as a result of this campaign.

Among the speakers were J. J. Canavan, Chicago; J. C. Carter, Buffalo, and Executive Manager Aylesworth. The last-named said that the association stands directly back of these state campaigns to disseminate public utility information. Horace Davis, Lincoln, Neb., warned against expecting quick results from campaigns.

The manufacturers' advertising committee, P. L. Thomson chairman, reported on its efforts to second the work of the association's public relations committee. The plan adopted was for each manufacturer to devote a certain part of his scheduled space in trade papers, popular magazines and newspapers to telling in his own way the story of the indispensability of a solvent and prosperous electric light and power company in every progressive community. "This we have been doing," the committee declares, "and this we propose to continue to do." Forty-seven manufacturers have been carrying on this work or have pledged space, and the number of mediums already used and scheduled reaches seventy-two, with an aggregate circulation in excess of 9,440,000.

The report of the public policy committee, presented by Chairman S. Z. Mitchell, comprehensively discussed conditions in the industry during the past year, pointing out that the deflation process is still far from complete. Slowness of recovery is due primarily to frozen credits and the enormous demand for money. As the old high prices in inventories are liquidated the amount of money required to do business at the new price is greatly decreased.

The buyers' strike has materially reduced demands for power service in many of the industrial districts and is giving impetus to the deflation of labor and commodity prices. Member companies during the past few years have been forced radically to revise their rates, which have in large measure been changed to give them a larger fixed or minimum charge. This, together with some increases in lighting and small power business and with some rate increases, has enabled the companies to pass successfully the crisis of high operating costs. Coal costs and labor costs for plants have been reduced but little, and freight on fuel has been largely increased. The past year has been marked generally by a more favorable attitude of the public toward the light and power industry. The decisions of the public utility commissioners have, generally speaking, been fair and in the interest of both the company and the public. The greatest drawback to the public regulation is that the commissions have so much work piled up on them and in many cases have had so little appropriation for help that it has been absolutely impossible for them to give

decisions in rate adjustments quickly enough to protect either the public or the companies.

As a result of the co-operative work of this association, the National Association of Railway and Utility Commissioners and the American Gas Association, the industry will soon have before it for the first time an acceptance accounting system which will apply throughout the United States.

Regulation and Finance

The value of frankness in setting forth the inside conditions and the problems of public utilities in dealing with the commissions was emphasized by R. H. Ballard, chairman of the committee on relations with regulatory bodies. Well-managed companies following this policy reap their reward before such tribunals.

High tribute was paid to the cordial co-operation between the N. E. L. A. and the Investment Bankers' Association by M. S. Sloan, chairman committee on relations with bankers. The latter has prepared much publicity material emphasizing the value of public utilities to all investors.

R. H. Ballard, Los Angeles, suggested the establishment of cross-memberships to interlock sessions of the investment bankers and the N. E. L. A. Frank W. Smith, New York, commended visits of bond salesmen to utility plants.

The cultivation of public good will as a goal was strongly emphasized in the report of the committee on upbuilding the industry, by F. R. Coates, chairman. The committee advocated an unflinching stand on behalf of adequate rates and throwing overboard timorous policies and apologetic attitudes in dealing with the public. The confidence of a million and a half American citizens holding utility securities and of several millions more indirectly interested through banks and insurance companies must not be destroyed or shaken. Any country is safe with its citizens saving more than they spend, the committee said, but it is the duty of every utility management not only to fight for its rights, but to protect the army of its stockholders. The strategical value of customer ownership was strongly emphasized. Utilities should cultivate the natural pride resulting from home-owned institutions.

An informal report was presented by W. W. Freeman, chairman of the committee on public utility taxation and uniformity of regulatory laws, showing that the committee has confined its attention to preliminary work.

Martin Insull, Chicago, was elected chairman of the Public Relations Section for the ensuing year.

F. R. COATES
President and General Manager
Toledo Railways & Light Co.

S. Z. MITCHELL
President
Electric Bond and Share Co.

W. W. FREEMAN
President
The Union Gas & Electric Co.

M. S. SLOAN
President
Brooklyn Edison Co.

R. H. BALLARD
Vice-pres. and Gen. Mgr.
Southern California Edison Co.

J. F. GILCHRIST
Vice-president
Commonwealth Edison Co.

F. R. JENKINS
Mgr. Central Station Institute
Commonwealth Edison Co.

P. L. THOMSON
Advertising Manager
Western Electric Co.

Chairmen of public relations committees who presented reports at Chicago: Mr. Coates, committee on upbuilding the industry; Mr. Mitchell, committee on public policy; Mr. Freeman, committee on public utility taxation and uniformity of regulatory laws; Mr. Sloan, committee on relations with bankers; Mr. Ballard, committee on relations with regulatory bodies; Mr. Gilchrist, committee on utility information; Mr. Jenkins, committee on accounting education; Mr. Thomson, committee on manufacturers' advertising

Practices and Tendencies in Steam Generating Plants

Upper Temperature Limit Temporarily Reached According to N. E. L. A. Committee, but Further Economy in Raising Steam Pressures Appears Promising—House Turbine with Heater Condenser or Straight Electric Drive with Bleeder-Type Prime Mover Favored for Heat Balance

BOILER ROOM CONVERTED TO OIL BURNING, SHOWING AUTOMATIC CONTROL USED WITH MECHANICAL BURNERS, FALL RIVER ELECTRIC LIGHT COMPANY

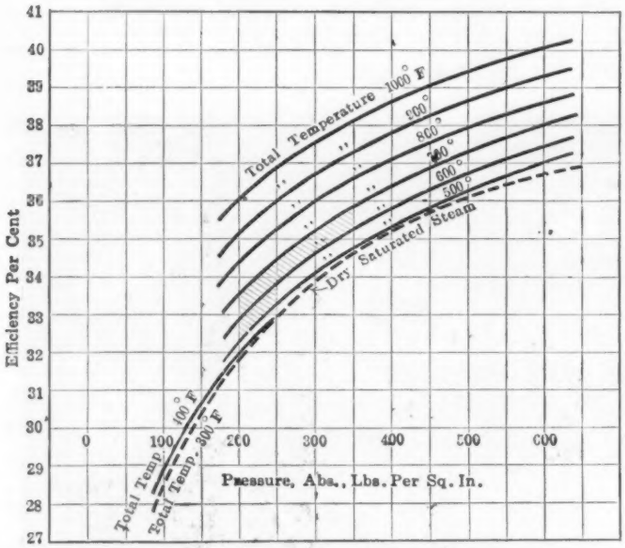
A TENDENCY to increase turbine speeds and to improve turbine economy by raising steam pressure is indicated in the report made to the National Electric Light Association by its prime mover committee, of which N. A. Carle is chairman. However, present knowledge of materials does not justify raising steam temperatures appreciably beyond the existing maximum limit of 700 deg. Fahr. (370 deg. C.). Single-cylinder turbines seem to be still limited to 45,000 kw. For maintaining a heat balance, sentiment among the operating companies appears to be crystallizing in favor of the house turbine in combination with a heater condenser or straight electric drive with bleeding of the main units for feed-water heating. One of the most important activities of the prime mover committee has been the formulation of an operating code the object of which is to recommend the most suitable methods of operating and maintaining generating stations to insure continuity of service and efficiency. Regarding the burning of lignite coal, it is said that good progress has been made abroad, but in this country there does not appear to be sufficient knowledge of how to utilize this fuel efficiently. For the benefit of small-size companies an excellent analysis of the relative economy of various prime movers has been compiled.

During the past year turbine manufacturers have directed their efforts toward improvement of details affecting reliability and operating efficiency. A number of them are working on the development of a closed system of generator ventilation in which the same air is constantly recirculated. The idea is to obtain cleaner air and to reduce first hazard to a minimum. The wide variation in characteristics of turbine lubricants has led the committee to formulate a tentative set of general specifications, which are given in the report. In addition attention is called to an interesting development in turbine foundation design known as the three-point flexible suspension and intended to guard against destructive effects of vibration.

Because of the seasonal variation in cooling-water temperature, both utilities and manufacturers are giving more attention to regulation of circulating water than usual. This scheme, if practicable, will reduce the power required for driving circulating pumps and will avoid lowering the condensate to a temperature below that corresponding to the vacuum. Leakage from condensers should be guarded against, the committee warns, particularly if it is at all serious, because the expense of feed-water treatment will be very materially increased. Methods of avoiding leakage are suggested.

A new record as regards boiler sizes was established for the United States during the past year by the

installation at the Ford Motor Company plant of four boilers each rated at 2,647 hp. Pressures and superheats are said to be gradually rising, although 300 lb. to 350 lb. (21 kg. to 24.5 kg. per sq.cm.) and total temperatures of about 650 deg. Fahr. (343 deg. C.) seem to be as high as boiler designers are willing to go at the present time. The high cost of economizers has led to the development of boilers with a higher tube bank, which will give at least part of the saving that could be



MAXIMUM GAIN IN EFFICIENCY OF STEAM TURBINES DUE TO INCREASING PRESSURE AT CONSTANT TEMPERATURE. GAINS WOULD BE SOMEWHAT OFFSET BY LEAKAGE AND WINDAGE

realized with an economizer. Two important developments by the manufacturing companies are reported, one being soot-blowing equipment which is designed to blow tubes automatically at a predetermined time. Superheaters are also being developed for separate firing which are intended to eliminate superheat fluctuations.

Satisfactory progress is reported by the American Uniform Boiler Law Society during the past year.

Although the cost of economizers is considered high, excessive fuel cost has partially offset this consideration so that some development is reported by manufacturers of steel-tube economizers. In operating them corrosion, both internal and external, is considered the most serious problem. Internal corrosion, which is generally due to the presence of excessive amounts of oxygen and CO_2 in the feed water, may be prevented by freeing the air from dissolved gases. The combination of moisture condensing on the outside surface of tubes with the sulphur compounds in flue gases is held to be chiefly responsible for external corrosion, and the remedy that is prescribed is to raise the temperature of the inlet water to the point where condensation does not take place.

Of the two methods devised for maintaining heat balance in the larger stations the house turbine and condenser heating method is considered the more desirable in plants without economizers. This method has the advantage of providing an immediate method of eliminating oxygen without the addition of de-aërating equipment.

Bleeding of prime movers seems particularly desirable in plants having economizers, owing to the limited amount of exhaust steam required at light loads and the possibility of but slight increase in prime-mover water rate at the heavier loads. One company favors house turbines and electric auxiliaries in order to limit the cost of auxiliary switching and to reduce short-circuit currents obtainable on auxiliary circuits.

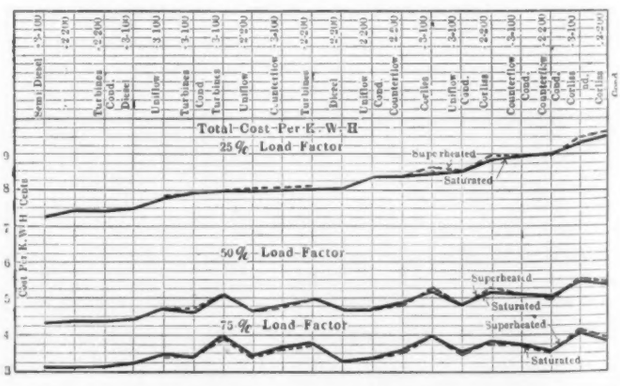
COMPARATIVE ANALYSIS OF SMALL PRIME-MOVER PERFORMANCE

Regarding small prime movers, the activity of the committee was directed chiefly to a study of design features and operating costs of a 200-kw. central station with various classes of prime movers installed. The following prime movers were considered: (1) Uniflow engines; (2) counterflow engines, including piston-valve, slide-valve and four-valve types; (3) turbines, both direct-connected and geared; (4) slow-speed belted Corliss engines; (5) Diesel engines, and (6) semi-Diesel engines. In calculating the operating costs coal having 13,500 B.t.u. per pound was assumed to cost $7 per ton delivered and oil containing 18,500 B.t.u. per pound was considered to cost $3 per barrel delivered.

Under the conditions assumed and with present prices of equipment, there is no very wide variation in costs whatever the type of apparatus used. The lowest total cost per kilowatt-hour is realized by the semi-Diesel engine and the condensing turbine, the former having a slight advantage. However, the difference in total cost per kilowatt-hour between the two classes of prime movers is so small, the committee concluded, that the turbine plant would probably be more desirable on account of its lower first cost. Contrary to general belief, the lower steam rate which obtains with superheated steam is in virtually all cases offset by higher fixed charges and fuel costs, and except in the case of turbines no net gain is realized by operating the plants condensing.

BURNING LOW-GRADE FUEL

Rather complete information regarding the burning of "hogged fuel" by the Northwestern Electric Company at Portland, Ore., is included in the report. This fuel shows a loss of from 30 to 40 per cent in B.t.u. content



TYPICAL GENERATING COSTS IN SMALL STATIONS FOR VARIOUS TYPES AND COMBINATIONS OF PRIME MOVERS

after being in storage a year, and it apparently makes little difference whether the storage is indoor or outdoor. Some fires have been experienced in storage piles, but it is said that if care is taken to remove the fine dust which gradually collects about a plant trouble from this source may be almost eliminated.

Contrary to expectations, the use of lignite did not receive any great impetus as a result of the acute

demand for fuel during the war period in the United States. This is attributed to a lack of knowledge of how to get efficient results from fuel of this type as well as to the storage difficulties, which are usually serious. However, very complete tests of lignite have been carried on both in the Bitterfeld station in Germany and at the Melbourne plant in Australia, so that the properties of this fuel under various operating conditions, as well as the design features to be embodied in stokers and furnaces, have been clearly defined.

Continued interest has been manifested in the pulverized-fuel method of burning coal. Aside from the restrictions imposed by the layout of old stations in changing over from grates or stokers to pulverized-fuel equipment, the question of high boiler ratings does not seem at all serious. High ratings are said to be obtained in new plants where boilers have ample combustion space and are designed expressly for burning pulverized fuel. The Lakeside plant in Milwaukee, designed for burning pulverized fuel, has recently been put in operation and will have an ultimate capacity of 200,000 kw.

Processes for the recovery of by-products from raw coal have been developed further in England and Germany than in this country. It is reported, however, that more development of by-product recovery processes in this country is anticipated.

The development of new types of boiler-room and turbine-room instruments during the year has been very encouraging, although no complete data are at hand covering the performance of the new types under conditions of actual operation. Among the new instruments are: (1) Recording pyrometers for indicating boiler furnace temperatures, (2) combined CO_2 and CO recorders, (3) multiple-type draft gages, (4) flow meters for indicating small rates of flow of liquids under pressure, such as bearing oil or jacket water, and (5) meters based on the principle of the alternating-current potentiometer for detecting condenser leakage.

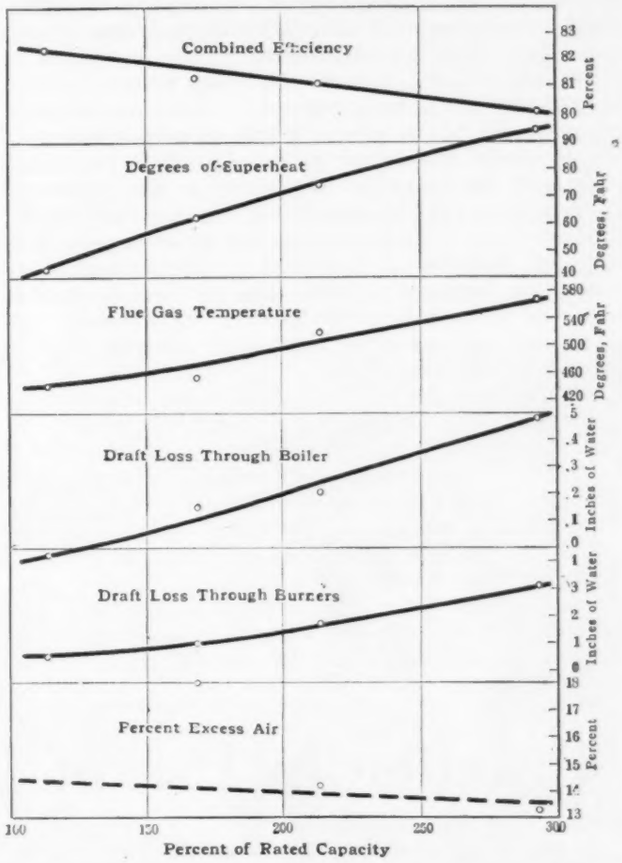
Present practice in the installation of fuel-oil storage tanks favors the steel tank with steel roof or the concrete tank. The heating of oil to insure its ready flow through piping systems makes it necessary to have the best materials and workmanship, because leakage of hot oil is dangerous and expensive. There is no more important item of equipment in an oil-fuel installation than the oil heater, the committee declared.

Promising Progress in Burning Liquid Fuel Efficiently

Successful burning of oil requires that boiler designs take into account other factors than the question of sufficient furnace volume. The type and location of baffles, location of burners, thickness and kind of refractories and a number of other equally important considerations have a marked effect on operating results. While steam atomizing burners have been in use for a number of years in stationary plants, it is only recently that mechanical burners have been employed to any extent. It is claimed by some manufacturers that the mechanical burners use very much less auxiliary steam than a steam-atomizing burner. This claim seems well founded according to the committee's report, and is substantiated by the experiences of a New England plant, which show that only two-thirds of 1 per cent of the total steam was used by the mechanical burners.

It is further claimed that a boiler equipped with mechanical burners will have a very much better efficiency at high rating and that for this reason outputs of about 210 per cent of rating are had for weeks at a time without destructive effect on brickwork or tubes.

A number of important manufacturers have added oil engines to their list of products, thus indicating their



EXCELLENT RESULTS HAVE ATTENDED PROGRESS IN LIQUID FUEL BURNING AS SHOWN BY TEST RESULTS OF THE SAVANNAH ELECTRIC COMPANY

belief in the future of this type of engine for stationary service. The future of oil engines for stationary plants depends largely upon the ability of manufacturers to develop engines which will successfully burn residues and heavy asphalt-base oils, because the growing demand for gasoline and lubricating oil will result in extensive cracking of crude petroleum.

As contrasted with the extremely conservative and even pessimistic views which have been expressed concerning the future of the oil supply, the committee calls attention to the very encouraging estimates of geologists concerning the reserve supply of oil which can be extracted from the enormous oil-shale deposits in the United States.

A questionnaire sent to operating companies using evaporators for feed-water purification indicates that evaporator equipment, while a comparatively recent development, is successful in central-station plants, provides pure water at a reasonable cost and justifies the installation and operating expense. It is reported that the internal use of any substances in boilers, whether for the purpose of reacting chemically or aiding mechanically in the elimination of boiler water impurities, seems to be coming into general disfavor. Except in a very few cases, it is more satisfactory to treat the water in separate treating apparatus. An excellent

indication of the importance of clean water is evidenced from the number of companies which are employing chemists to make periodic tests of feed-water composition. Even where it is not practicable to employ a chemist, excellent results are said to be obtained for certain purposes from the use of portable testing outfits which can be operated satisfactorily by inexperienced men after a very little instruction.

Marked activity toward adapting present stoker designs to low-grade coals has been manifested, evidently due to the excessive cost of high-grade coal. The successful application of forced draft to the chain-grate and conveyor-type of stokers is also reported. Packing of coal and irregularity of feed can be virtually eliminated, it is said, by the use of power-operated agitators installed at the base of the hopper. An interesting development which has not been in service very long is an attempt to control stoker speeds and speeds of fans and other auxiliaries automatically by changes in steam velocities.

Almost no trouble has been experienced from spontaneous combustion in coal piles during the past year, owing chiefly to the fact that coal stocks have been low. Furthermore, the use of heated sheds or tunnels has not been adopted by large companies for thawing out frozen coal on account of the large investment cost. Car dumpers and pneumatic chisels appear to offer an effective means of unloading at a very much lower cost.

Some companies have expressed the feeling that coal crushers of large capacity have been developed at a sacrifice of uniformity of the crushed product. A decrease in the peripheral speed of the rolls is suggested as a probable remedy. Since some difficulty has been experienced with automatic coal samplers owing to their failure to extract representative samples. Care should be exercised in the selection of such equipment.

A few years ago line welds were considered advisable to reduce the number of flanged joints, the report said, but experience of operating companies gained since that time has indicated that they may be dangerously weak unless very carefully made. Nearly all stations using steam above 200 lb. (14 kg. per sq.cm.) have standardized on steel-body gate valves with complete monel-metal trim. Both hydraulically and electrically operated valves are being extensively used, a preference being shown for the electrically operated valve. Some type of valve is in demand which will shut off steam to the turbine room in case of accidents to turbines or their steam piping, but arrangements that will serve this purpose have not yet been devised. A great variety of color schemes are in use by the member companies for indicating different classes of piping, and the committee expresses the hope that a standard color scheme can be agreed upon. Attention is called to the fact that the American Society of Mechanical Engineers is revising piping standards for pressures higher than 250 lb. (17.5 kg. per sq.cm.), acting as the sponsor body designated by the American Engineering Standards Committee with a view to adopting an American standard for such pressures. A member of the prime movers committee has been appointed to represent the users of pipe and fittings on the sectional committee.

Practice in Use of Electrical Apparatus

Closed-Circuit System of Ventilating Turbo Generators Coming Into Favor—Tendency Toward Greater Use of Electrically Driven Auxiliaries—Data on Oil-Circuit-Breaker Performance

CLOSED-CIRCUIT generator ventilation, a distinctly new type of switch-house design,* the electric drive of auxiliaries, oil-switch performance and transformer-oil standardization are subjects of special interest in this year's report of the N. E. L. A. electrical apparatus committee, of which R. F. Schuchardt is chairman. As in former years, the work of the committee was divided among sub-committees dealing respectively with generating stations, oil circuit breakers and switchboard equipment, transformers, substations, motors, service voltage and special fields. Among subjects considered by these sub-committees aside from those mentioned were generator-fire fighting and relay protection, direct-current test sets, shunting of reactors, and transformer polarity standardization. Progress in automatic substations, adoption of motor rules, use of alternating-current motors for elevators, action on 40-deg. versus 50-deg. motors, service voltage standardization and application of electrical apparatus in special fields were also discussed.

In the closed-circuit system of generator ventilation air is circulated through a closed system of ducts and cooled by passage through water-spray or radiator-type coolers. According to the report, this arrangement minimizes fire hazard by failing to sustain combustion and besides provides cleaner air and hence lower operating temperatures and longer life of insulation. In the Narragansett Electric Lighting Company's plant the heat from the generator cooling air is utilized to raise the boiler feed-water temperature. The closed-circuit system will be used in the new station of the Hartford Electric Light Company and the Calumet station of the Commonwealth Edison Company.

MOTOR DRIVE FOR STATION AUXILIARIES

One of the most interesting points brought up by the committee was the very definite trend toward the greater use of electrically driven auxiliaries. One of the large stations now under construction will have all auxiliaries electrically driven, with the exception of two or three steam reserves such as emergency boiler-feed pump. All of these auxiliary motors are to be alternating current and motors above 25 hp. will be rated at 2,300 volts.

In the application of alternating-current motors to auxiliary drive one of the chief problems has been to obtain the desired adjustment of speed: One method of overcoming these difficulties has been to use constant-speed motors with some form of mechanical speed-changing device or the multi-speed pole-changing motors with or without mechanical speed-changing device.

*See ELECTRICAL WORLD, April 2, 1921.

Slip-ring motors with external resistance have also been used and recently the brush-shifting commutator type of motor has been made available. This motor is more efficient for such service than the slip-ring type, according to the committee, particularly when the average running speed is much lower than the maximum. Its cost, however, is considerably higher than that of the slip-ring type, and it has the disadvantage of having a commutator. Moreover, it is not readily adaptable to differential-relay protection. Such motors were installed for boiler-fan drive in the Springdale plant of the West Penn Power Company, recently placed in operation, and a similar installation is planned in another large station now under construction.

Starting of constant-speed alternating-current motors has, in the past, generally involved the use of individual-starting compensators installed at the motor. However, it is possible to start motors from a common starting bus supplied by auto-transformers or from the taps of the power transformers. The Colfax station of the Duquesne Light Company, recently placed in operation, uses auto-transformers, while in the Calumet station of the Commonwealth Edison Company, now under construction, taps on the power transformers are to be employed. Protection of auxiliary motors is being developed along the lines of the differential-relay schemes of protection which have come into extensive use for generators, transformers and cable protection and more recently for motor work.

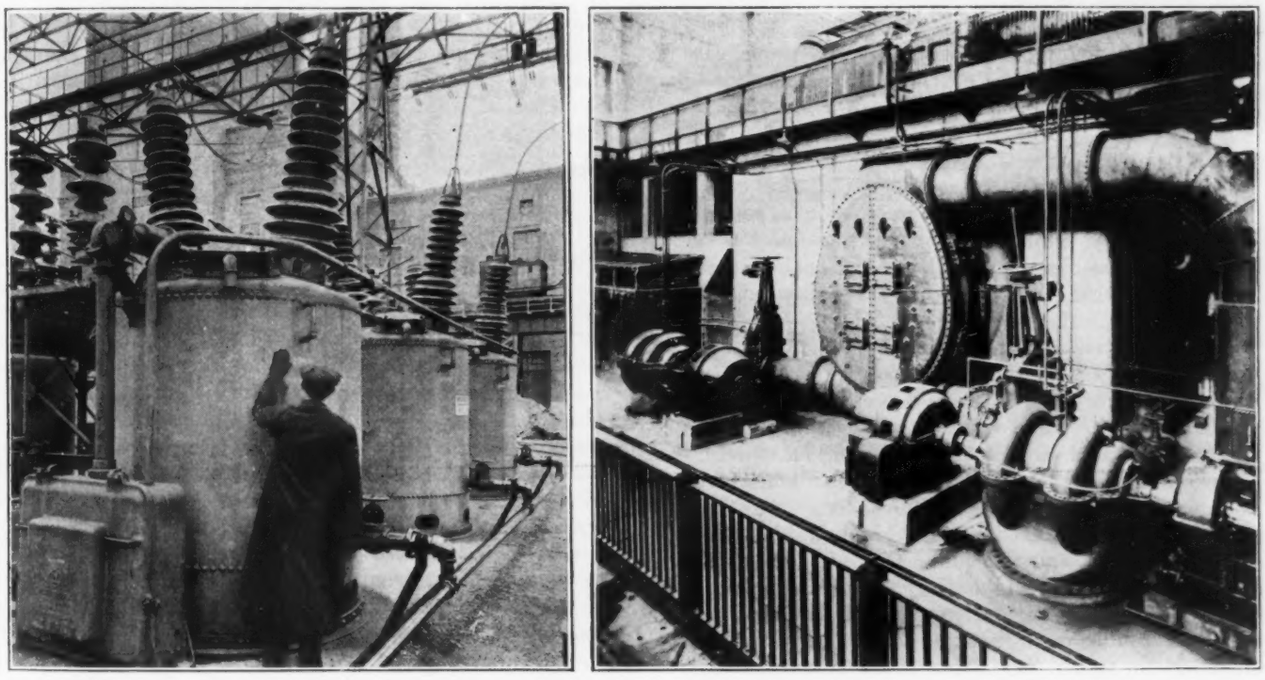
Differential protection of generators and fire-extinguishing equipment are considered very important. In one case of generator failure in which the unit was protected with differential relays the generator was so promptly disconnected that the damage was slight. In another case where the relay protection was lacking but fire-extinguishing equipment was provided the fire which started was readily extinguished by the application of steam.

From the investigation which the committee made of oil circuit breakers it is evident that the present specified duty cycle, which is to open twice and then to be closed and carry the rated current until it is practicable to inspect the breaker and make any adjustments which may be found necessary, does not permit as large a number of times of openings or as short an interval between openings as is required for distribution service. On the other hand, for high-tension cable circuits, this present duty cycle provides for one more opening and for a shorter interval than is usually required in practice. For overhead high-tension transmission the manufacturers' duty cycle is in general agreement as to the number of times the breaker is closed, but does not give a sufficiently short time interval to agree with operating practice.

In answer to the question whether oil circuit breakers should be rated at their ultimate interrupting capacity or in some percentage of that value, thirty-one companies favored an ultimate rating while eighteen favored a factor of safety of two. Five companies thought the question immaterial.

Oil breakers are inspected yearly by twenty-three companies, while eleven companies follow a schedule inspection of every six months. Other companies have schedules calling for inspection at intervals of three months, one to one and one-half months or every two years, and a few companies have no definite time for inspection. It is almost universal practice, however, to inspect an oil breaker at once if it shows signs of severe stress, and a number of companies make more frequent inspection of breakers used for hard service than for other equipment. The nature of the periodic inspections is generaly to remove the oil, test it and filter, if necessary, to examine, adjust and repair all contacts and operating mechanisms, and to examine the condition of bushings, tanks, etc.

Changing the speed of mechanical operation of oil



OIL-CIRCUIT BREAKER OPERATING PROBLEMS AND ELECTRIFICATION OF STATION AUXILIARIES WERE TWO IMPORTANT STUDIES MADE BY THE ELECTRICAL APPARATUS COMMITTEE

breakers to give a faster parting of contacts has been reported on favorably by nine companies. The operation was considerably improved when the speed of opening was increased, since the life of the contact was prolonged, oil throwing reduced and distortion of tanks prevented. The increase in speed was put as high as 100 per cent in two cases.

It was stated by the representatives of the Power Club present at the January meeting of the electrical apparatus committee that the benefits to be derived from speeding up oil breakers would be found beneficial only to old breakers or to those on which the normal operation had been slowed down by long operating rods, many bell cranks or stiff operating mechanism. The representatives claimed that modern breakers are so designed and constructed that little increase of interrupting capacity is to be expected by an increase in speed of contact separation.

It seems to be the general practice to test the oil and filter or change it, if necessary, when the breakers are regularly inspected or when they have opened short circuits and it is suspected that the oil has been damaged. A number of companies make a practice of testing the oil at more frequent intervals than those at which periodic inspections are made and then filtering or changing if found necessary. Of the companies replying to this question, six have such a periodic inspection yearly, while nine companies inspect every six months, eighteen comapnies have no routine inspection and a few other companies vary the inspection from one to four months.

Several other points were investigated, such as troubles due to operating breakers outdoors in cold climates. Temperatures were reported as low as 50 deg. Fahr. below zero, and where low-freezing oil was used no trouble has been experienced. About thirty companies reported that oil from different manufacturers was used interchangeably in breakers. In all cases where oil was so used no trouble had been reported because of the substitution. Only a few companies reported trouble from heating of oil circuit breakers under normal operating conditions, although several cases of trouble were reported when breakers had been installed in poorly ventilated compartments.

In an investigation of oil-circuit-breaker failures it became evident that electrical storms are responsible for more failures than any other cause. Another cause for failure has been that the system outgrew the interrupted capacity of the breakers. In this connection the committee recommended that careful study of existing conditions be made in order that steps may be taken to eliminate hazardous equipment.

QUESTION OF RATING IMPORTANT

From the investigation which the committee made it is evident that no rating based on one particular duty cycle, such as opening twice with a two-minute interval, gives sufficient information to the operating engineer, who may desire to use the breaker for several different classes of service, thereby necessitating his resorting to the manufacturer for information as to the rating on some duty cycle other than the standard. It is also clear that the ideal way of showing the interrupted capacity capabilities of a breaker would be to have curves or tables which would give the current the breaker would interrupt for various numbers of openings and for various time intervals between openings.

Manufacturers, however, hesitate to adopt the foregoing method because of the difficulty and expense involved in determining so many ratings for each type, size and voltage of breaker. On the largest breakers the determination of the actual limitations would depend largely upon the assistance of operating companies in permitting the use of their generating equipment for tests and in reporting the results of breaker operation under abnormal conditions. The expense involved in determining the above rating would no doubt be reflected in the cost of the breakers.

Steps were taken, however, to make a series of tests in conjunction with the Power Club which would determine, first, the current which a breaker would interrupt once; second, the current which the breaker would interrupt twice with a two-minute interval; third, the current which the breaker would interrupt four times with intervals of one-half minute; fourth, the current which the breaker would interrupt 300 times at intervals of not less than fifteen minutes. At the present time these data have not been completed, but it is hoped that their preparation will furnish the preliminary step toward the development by manufacturers of curves of interrupted capacity rating for breakers of other types, sizes and voltages.

ALTERNATING-CURRENT MOTORS GROWING IN FAVOR FOR ELEVATOR SERVICE

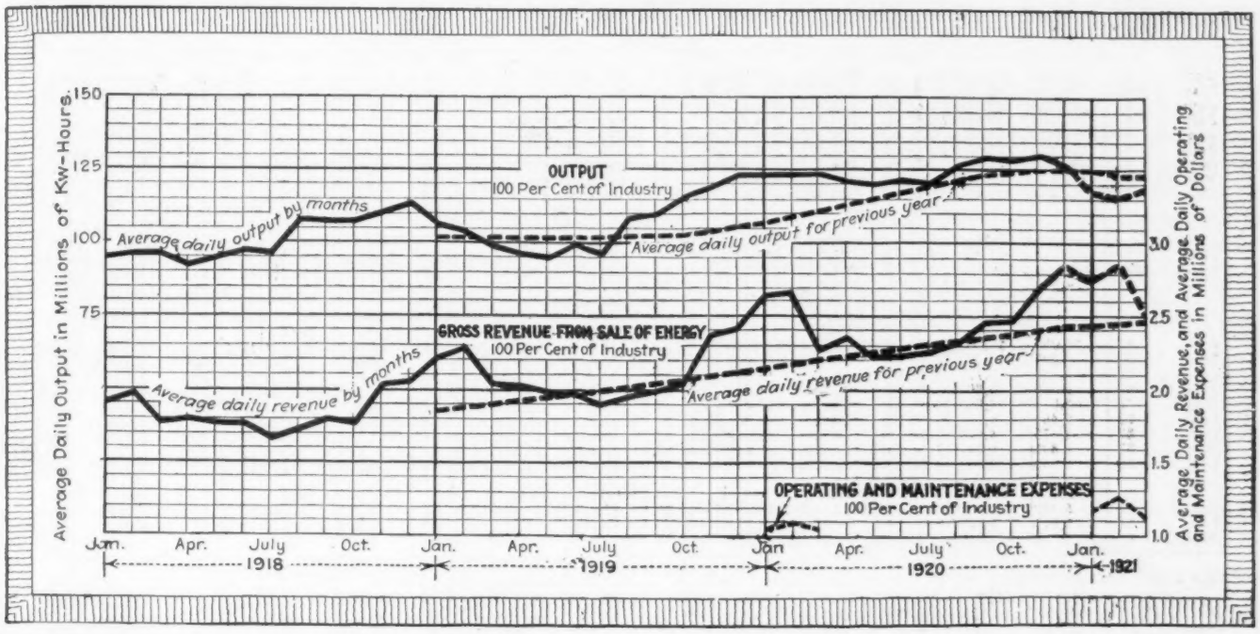
One of the interesting features pointed out by the sub-committee on motors was the growing interest in the use of alternating-current motors for high-speed passenger-elevator service. Of twenty-one manufacturers communicated with fourteen are making passenger elevators and are prepared to furnish alternating-current machines in speeds varying from 200 ft. to 450 ft. (60 m. to 137 m.) per minute. Several companies are experimenting with car speeds of 50 ft. to 550 ft. (15 m. to 167 m.) per minute. Contrasted with the general opinion that direct-current elevators predominate is the statement by the Otis Elevator Company that for the year 1920 the alternating-current elevators bought from it for use in this country were 57 per cent of the total number, and that of the remaining 43 per cent gearless-traction type were 9 per cent.

Service voltage standardization has been very carefully considered by a sub-committee appointed for this purpose, and data from the lamp committee of the N. E. L. A. and from the lamp manufacturers have been summarized. It is shown, for instance, that 51 per cent of the operating companies are using 110-volt lamps, while 21 per cent are using 115-volt lamps and 6.9 per cent 120-volt lamps. Lamps are in use, however, ranging from 100 volts to 130 volts in 1-volt steps and operators can be found using some one voltage in this range.

A tentative recommendation was drawn up by the committee favoring the standardization of 115 volts for lamps and electric household appliances having a voltage range from 110 to 120. Motors are recommended for a voltage of 110.

The sub-committee on apparatus for special fields presented an illustrated account of the development of electrical applications in the fields of woodworking, pulp and paper making, electric furnaces, textile mills, motion-picture production and projection, coal mining, surface excavating, car dumping, and in connection with byproducts coke ovens. In each of these fields present-day practice has been outlined.

Central-Station Operations Reflect Greater Industrial Activity During March



RETURNS of central-station operations received by the ELECTRICAL WORLD for March clearly indicate a material resumption of industrial activity in every section of the country. In spite of the rapidly advancing season and the correspondingly decreased lighting requirements, the average daily output was 100,000 kw.-hr. in excess of that reported in January and 2,200,000 kw.-hr. in excess of the February output. The estimated total output during March of 3,648,000,000 kw.-hr. was, however, 8 per cent below that of March, 1920; but it must be remembered that spring last year saw some of the most intense industrial activity in the history of the nation.

Electric light and power companies, representing over 53 per cent of the industry, are now reporting monthly operating and maintenance expenses to the ELECTRICAL WORLD. The returns for March indicate that while the average daily output was about 2 per cent above that of February, the operating and maintenance expenses were more than 9 per cent under those reported for February. In two sections of the country this comparison between output and expenses was even more pronounced. The North Central States reported an increased daily output of 2.3 per cent and a 13.1 per cent decrease in operating and maintenance expenses, while the Mountain and Pacific States reported an increased daily output of 8 per cent and a 13.5 per cent decrease in operating and maintenance expenses. There are a number of causes contributing to this downward swing in cost of generating energy, among the more important being lower wages, lower cost of fuel, lower cost of supplies and the shutting down of a number of steam auxiliary plants owing to bountiful rains.

The general textile situation in New England showed a marked improvement over February, when many plants were shut down. The boot and shoe industry of that section, which accounts for over 50 per cent of the shoe production of the United States, increased operations slightly over February, but was still operating at only about 50 to 75 per cent capacity. These and other increases in the industrial load of this section resulted in an increased daily energy output over February of 280,000 kw.-hr.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase
April	70	2,603,692	2,098,559	24.1	65	$45,547	$36,541	24.5
May	70	2,631,560	2,179,916	21.2	65	43,888	35,512	23.4
June	71	2,630,831	2,175,645	20.2	66	44,434	35,528	24.5
July	71	2,677,131	2,234,215	20.0	66	46,608	36,265	28.5
Aug.	71	2,769,175	2,303,099	20.1	66	47,410	36,713	29.1
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct.	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov.	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan.	76*	2,765,632	2,943,349	-6.0	70*	58,855	50,861	15.8
Feb.	76†	2,456,553	2,711,251	-9.4	70†	55,778	48,624	14.8
Mar.	77‡	2,812,493	3,179,943	-11.6	72‡	55,706	49,014	13.7

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1921	Steam Plants 1920	Hydro Plants 1921	Hydro Plants 1920	Combined Systems of Steam and Hydro 1921	Combined Systems of Steam and Hydro 1920
Jan.	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar.	53	18,544	17,125	8.4	56.1	57.7	23.4	19.6	40.3	44.8

* Includes estimates for twenty-three companies, representing 3.6 per cent of the total installed rating of all central stations.
† Includes estimates for thirty-five companies, representing 4.4 per cent of the total installed rating of all central stations.
‡ Includes estimates for sixty-nine companies, representing 10.8 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
		Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase
KW.-HR. OUTPUT	April	82	187,174	144,922	29.1	65	883,264	701,778	25.9	74	857,467	687,751	24.7	56	135,140	99,877	35.2	79	540,647	464,231	16.7
	May	82	188,566	148,186	27.5	65	854,631	711,276	20.0	74	862,127	700,095	23.5	56	137,779	98,815	39.2	79	588,457	521,544	12.6
	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,780	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept	82	194,730	170,593	14.1	66	905,872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
	Nov	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
	Dec	82	210,494	227,403	-7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	-0.3	81	556,561	550,685	1.1
	Feb	81	178,694	216,890	-17.6	77	901,942	969,318	-7.0	73	790,935	883,545	-10.5	63	131,654	132,537	-0.7	81	453,928	508,961	-10.8
	Mar	81	204,952	230,125	-10.9	79	1,028,624	1,117,441	-8.0	73	895,900	943,470	-5.0	63	139,650	136,971	1.9	81	543,367	751,936	-27.2
REVENUE			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	April	82	$5,087	$3,943	29.0	64	$17,700	$14,383	23.5	57	$12,690	$10,042	26.9	54	$2,952	$2,181	35.2	79	$7,118	$5,992	19.2
	May	82	4,897	3,741	30.1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32.0	79	7,067	6,147	15.1
	June	82	4,948	3,778	30.5	65	16,525	13,449	22.1	57	12,412	9,776	26.9	54	2,849	2,127	33.9	79	7,700	6,398	20.5
	July	82	5,009	3,802	28.5	65	16,899	13,438	25.5	57	12,822	9,793	30.9	54	2,747	2,194	35.0	79	9,131	6,948	31.5
	Aug	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept	82	5,489	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
	Nov	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
	Dec	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan	81	6,379	6,170	3.5	74	22,180	19,225	15.3	59	16,818	14,436	17.3	62	4,155	3,484	19.3	81	9,323	7,546	23.6
	Feb	81	5,925	5,728	3.4	74	21,489	18,317	17.4	59	15,981	14,071	13.7	62	3,915	3,329	17.6	81	8,468	7,179	18.0
	Mar	81	5,788	5,566	3.8	76	21,761	18,870	15.4	59	15,945	14,108	12.5	63	3,869	3,240	19.2	81	8,489	7,224	17.5
OPERATING EXPENSES:																					
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
	Feb	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,055	15.5	55	2,042	1,963	3.9
	Mar	46	1,560	1,642	-5.0	59	7,874	7,274	8.2	35	4,597	4,191	9.8	53	1,704	1,453	17.3	79	2,809	2,565	9.4

The Atlantic States presented two conflicting tendencies. In the Middle Atlantic States there was a materially increased activity among the industries closely allied with the automobile interests, but on the other hand the iron and steel industry and other metal products experienced a decidedly greater slump during the month, and the coal-mining districts, such as those of West Virginia, were operating at only about 25 per cent capacity. In the South Atlantic States conditions were reported as fast approaching normal in the textile and lumber industries, these two industries consuming over 46 per cent of the electrical energy generated in the Southern States. The increased power requirements of the South and of a few industries of the Middle Atlantic States were sufficient to overcome the curtailments of the steel and coal-mining industries, this resulting in an increased daily output in the Atlantic States of 3,600,000 kw.-hr. over that reported in February.

Similar conflicting tendencies were also experienced in the North Central States. The greatly decreased power requirements by the iron and steel industry were more than offset by the greatly increased energy requirements of the automobile and related industries, operations in which increased more than 63 per cent over those of February. But after accounting for the decreased lighting requirements the resulting energy output of this section was only slightly more than that reported for February.

Activity in all the copper, lead and coal mining centers of the Mountain States was considerably curtailed during March, and general industrial activity in this section was at a low ebb. Generally speaking, conditions throughout the Pacific States were slightly improved, and the daily central-station output of the Mountain-Pacific States was 8 per cent greater than that reported in February.

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

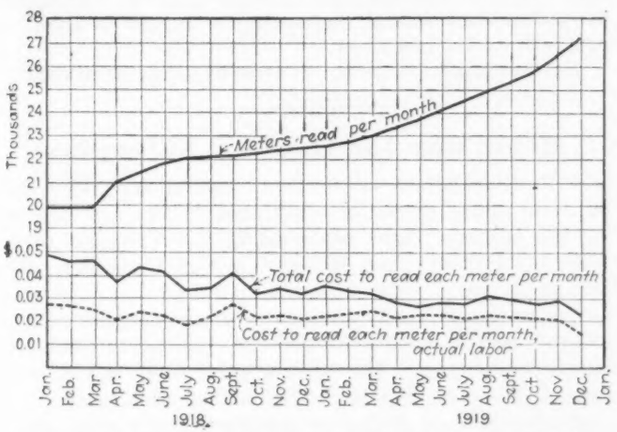
Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
Hydro Plants:																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Graphic Representation of Cost of Meter Reading

GRAPHIC charts aid the management of the Worcester (Mass.) Electric Light Company in visualizing the cost of reading meters. The chart, which is like that reproduced herewith, is made up from the monthly payrolls, which show the total cost of meter reading, the labor cost and the number of meters read



COST OF METER READING SHOWN CLEARLY ON THIS CHART

per month. It may be noticed from observing this curve that as the number of meters read per month has increased the cost of the reading has decreased.

Curves similar to this are used by the distribution department of the company for improving operation along other lines. Some of these have already been published in the ELECTRICAL WORLD and others will follow in later issues.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Maintaining Station Transformers

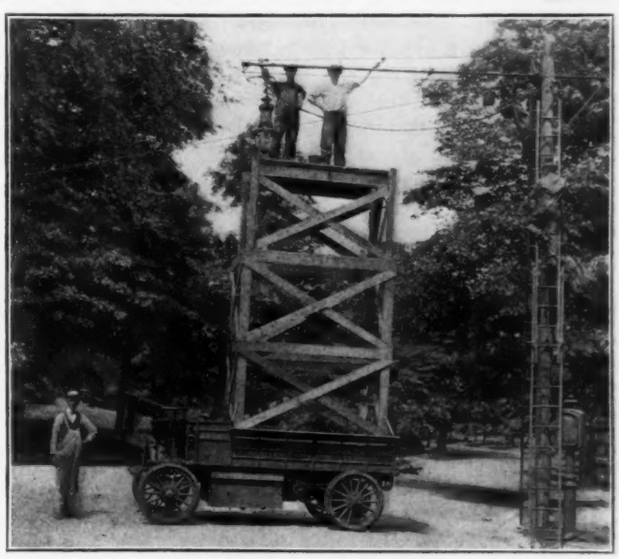
A SYSTEMATIC maintenance schedule for station transformers should call for oil breakdown tests every two to six months, depending upon the size and importance of the installation, and a thorough inspection, including filtering of oil regardless of its dielectric strength, lifting of core, tightening of nuts, checking for connections, etc., at least every three years. Water in transit oil detected at the time oil samples are taken can usually be removed and the leaks stopped without any serious loss, if the matter receives early attention.

Thorough overhauling will disclose a number of defects which might not be noticed in oil sampling or by inspection of the exterior. For instance, some 60-kv. transformers serving a cement plant were, after five years' operation, found with oil ducts clogged and all interior parts coated with a ½-in. deposit of sludge. After the cores and cases had been washed clean the operating temperature was lowered 7 deg. Oil samples taken from these transformers at three-month intervals had satisfactorily passed breakdown tests. The sludge, due to oxidation of the oil and breathing of cement dust, only came to attention at the overhaul period. During this period many imperfections or results of carelessness may be found, such as leads burned inside the case because of arcing, mechanical strain or too much slack on leads to bushings, tools accidentally left inside the tanks—cores and coils out of position—bushing assemblies distorted, and the wooden coil supports at bottom of transformers burned or carbonized, showing that there has been leakage of energy which would no doubt eventually cause failures.

G. W. SCHMAUDER,
Assistant General Manager.
Texas Power & Light Company,
Dallas, Tex.

Tower on Truck Makes Work of Painting Mast Arms of Street Lamps Easier

FOR painting the mast arms of street lamps the Worcester (Mass.) Electric Light Company has built the tower shown in the accompanying photograph. This is made of 2-in. x 4-in. boards and is mounted upon a 1-ton electric truck. The top platform can be raised and lowered by a pulley, and it clears the trolley wires when it is down. A man standing upon this tower can paint, sandpaper and oil the arms much faster than



PAINTING IS DONE MORE QUICKLY FROM THIS TOWER THAN FROM LADDERS

when standing upon a ladder. Moreover, it is not necessary to get down and shift the ladder from one position to another, thus wasting time. Another advantage is that the danger of accidents from falling ladders has been eliminated. FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

Bettering Efficiency of Hydro-Electric Plants

SUGGESTIONS toward the improvement of efficiency in utilizing water power are included in the latest report of the New Hampshire Public Service Commission on water conservation and water power in sections contributed by Prof. C. M. Allen, Worcester (Mass.) Polytechnic Institute, and C. H. Pierce, district engineer United States Geological Survey, Water Resources Branch, Boston. Professor Allen points out that the determination of present operating efficiency in hydro-electric plants has too often been sadly neglected. Experience has shown that, although some waterwheels thirty or forty years old are still doing good work, yet a much larger number should be scrapped and replaced with modern high-efficiency wheels.

One of the principal causes of low operating efficiency is improper wheel setting. It is impossible to make a poor wheel efficient, even by placing it in a good setting; but an efficient wheel can be tremendously crippled by placing it in a poor setting. With the exception of a few cases, the installation of larger wheels in the original settings has proved to be bad practice as regards efficiency, and in many cases little if any more power has been obtained. A considerable increase in power and efficiency can be obtained at little or no additional expense by simply taking as good care of the water-power installation as is ordinarily given to the steam-power plant. Thus waterwheels should be inspected every month or two to make sure that the shafts are lined up and the runners have proper clearance and are free from debris. Too many plant operators never give the waterwheels much thought until something happens. Breakdowns can often be avoided and a much higher operating efficiency obtained by systematic inspection. Trash racks should be kept free, as a considerable loss in head may otherwise result. A loss in head becomes a greater loss in power because if a wheel is properly chosen for the normal head, any drop from this head causes the wheel to operate at the wrong speed for best efficiency, especially at part-gate loads. The loss of head at racks in low-head plants may cause a serious loss in power.

If old-style vertical wheels stand idle during low-water periods, the buckets very often become covered with tubercles. These, unless removed, decrease the efficiency, sometimes from 10 to 15 per cent, and the power from 20 to 30 per cent, depending somewhat on the size of the wheel. Obstructions in the tailrace and draft-tube cause the water to back up and reduce the head. This trouble is all too common. Headgates not fully opened, owing to a poor rig or laziness on the part of the operators, are a frequent cause of reduced head and are inexcusable. If headgates are used frequently —and they should be in most plants—power-operated gates of some sort should be installed. They would pay for themselves in a short time, not only in the saving of labor but in the increased efficiency of the plant, owing to more frequent inspections. If wheels are shut down any considerable length of time on account of low water, the headgates should be closed and cindered to prevent leaks, the wheel gates not usually being tight enough for this purpose.

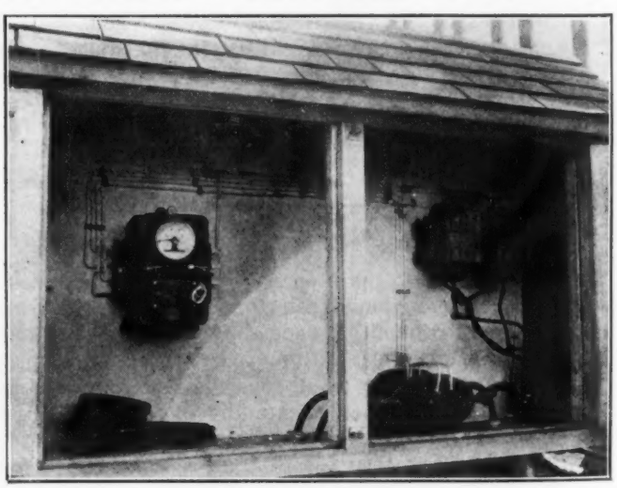
In some plants tests have shown that the wheels are often operated at the wrong speeds for maximum power and efficiency. Curves should be kept on hand showing the proper speeds to operate the wheels in order to obtain maximum horsepower for different heads and gate openings. These charts, combined with the use of a tachometer on the wheel shaft, will provide all the data necessary to get maximum output from the units.

Mr. Pierce points out that many old wheels use enormous quantities of water for the power developed and should be replaced, in many cases an entirely new plant arrangement being justified. More information at each plant in regard to the quantity of water used in producing a definite amount of power would be a great help toward reducing waste. Measured by recent improvements in water-power development, most of the small water-power plants built fifteen or twenty years age are very inefficient. Twenty to thirty per cent more power can frequently be obtained by redevelopment, using the same amount of water. At one redevelopment in Massachusetts, where the old and new plants were carefully tested, the increased power which was from the same quantity of water amounted to about 50 per cent of the old plant.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Meter Box for Outdoor Substations

CONVENIENCE in reading, testing and inspecting and ample space for additional meters are afforded by the outdoor meter box used by the Trinidad (Col.) Electric Transmission Railway & Gas Company. The box is of wood with shingled roof and has two glass doors to permit ready inspection of the interior. These doors may be locked to prevent tampering with the meter or wiring. The box is 3 ft. high, 4½ ft. wide and 1 ft. deep inside. The inside back wall is of transite, and on this are mounted the meter, meter wiring and potential transformers. The current transformers are mounted on the floor of the box. The 2,300-volt leads pass through porcelain insulators in the



GOOD ARRANGEMENT OF METERS AND TRANSFORMERS IN OUTDOOR METERING INSTALLATION

bottom of the box to the current transformers. Three 10-watt lamps mounted on the back wall are connected in star to the potential transformer secondaries. If any one of these lamps is not burning, it is an indication that something is wrong with the potential transformer connections. As the box is only 4 ft. from the ground, inspection and working on the meter and wiring is easy. FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

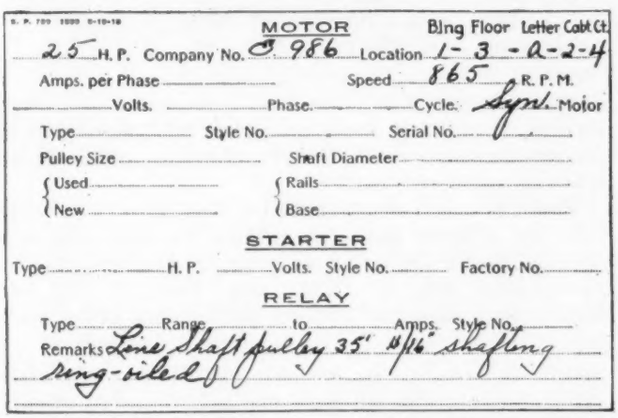
Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Convenient Motor-Record Card

A COMPACT index card for motor records was used at the East Springfield (Mass.) works of the Westinghouse Electric & Manufacturing Company during the period of munitions manufacture.

It is 4 in. x 5 in. in size and in addition to the usual motor nameplate data carries spaces for recording pul-


MOTOR
Bldg Floor Letter Cabt Ct.
25 H. P. Company No. 3986 Location 1-3-A-2-4
Amps. per Phase
Speed 865 R. P. M.
Volts. Phase. Cycle. Syn. Motor
Type Style No. Serial No.
Pulley Size Shaft Diameter
Used Rails
New Base
STARTER
Type H. P. Volts. Style No. Factory No.
RELAY
Type Range to Amps. Style No.
Remarks Line shaft pulley 35" 11/16" shafting
ring-oiled

CARD FOR KEEPING A RECORD OF MOTOR FEATURES AND PULLEY, STARTER AND RELAYS

ley and shafting details, starter and relay information. The notation at the upper right-hand corner specifies the building, floor, section, cabinet and circuit number. On the reverse side is space for a sketch of the driving arrangement adopted. R. P. King is plant engineer.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Changing 60-Cycle Motor for 40-Cycle Operation

A DEMAND for a 40-cycle motor for quick delivery was taken care of some time ago by the writer by changing over a 60-cycle machine to operate at the lower frequency. The requirements called for a 20-hp. motor of the slip-ring type to operate at 220 volts, 600 r.p.m., three phases and 40 cycles. The operation was to be at a variable speed with 50 per cent reduction in full-load speed over a part of the cycle of duty. After considering a number of 60-cycle machines one was found that could be connected readily to fulfill these requirements.

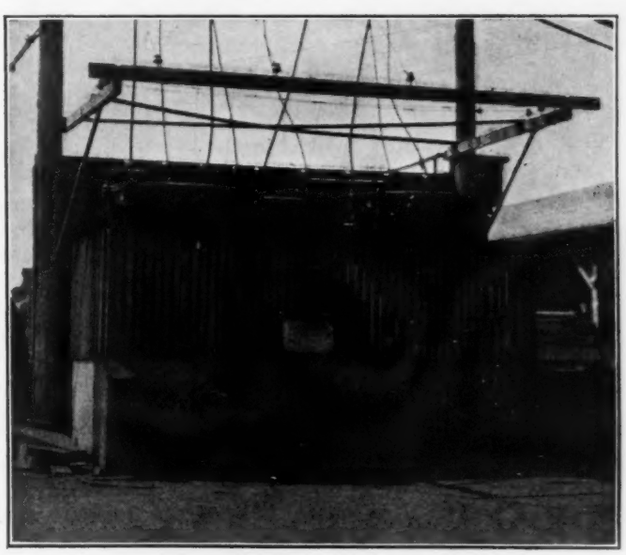
In the first place, to operate at 600 r.p.m. on 40 cycles the machine would have to operate at 900 r.p.m. on 60 cycles. A reduction in speed results in a corresponding proportional reduction in voltage that may be applied and in power. Therefore the motor would have to be rated originally for about 30 hp. A 35-hp. motor for 440 volts, three phases, 60 cycles, rated for a 40-deg. C. rise in temperature, was found. This machine was connected series-delta, and a two-circuit star connection gave a voltage of 380. This was for 60-cycle operation, but on a 40-cycle circuit the voltage applied to the two-circuit star winding should be only 254 volts. The line voltage, however, was 220. With a 35-hp. motor operated at 254 volts, the power delivered at 40 cycles would be $(35 \times 2)/3$. However, the motor was to operate on a 220-volt line instead of a 254-volt line. Therefore the horsepower would be still further reduced. Since the power varies as the square of the voltage, the resultant power on a 220-volt circuit would be as 220^2 to 254^2, or 79 per cent of the 254-volt rating. The final horsepower, therefore, would be $(35 \times 2 \times 0.79)/3 = 18.4$ hp. on a 40-deg. C. rise basis. As the motor was to carry a load of 20 hp. only at intervals, it was judged to be suitable for the work.

Accordingly the machine was reconnected and put into service and the necessary secondary resistance for starting and speed variations was found with little difficulty by trial. When last heard of the machine was carrying its load in a very satisfactory manner after eight or nine months of service. WILLIAM THOMSON.

New York City.

Oil-Filled Transformers Near Inflammable Material Set in Concrete Vat

WHERE oil-insulated transformers are installed on wooden structures or within 25 ft. of buildings some provision should be made to prevent the escape of oil in case of fire. To make such installations comply with the Underwriters' requirements, the Portland



CONCRETE WALL AROUND TRANSFORMERS INSTALLED NEAR SAWMILL

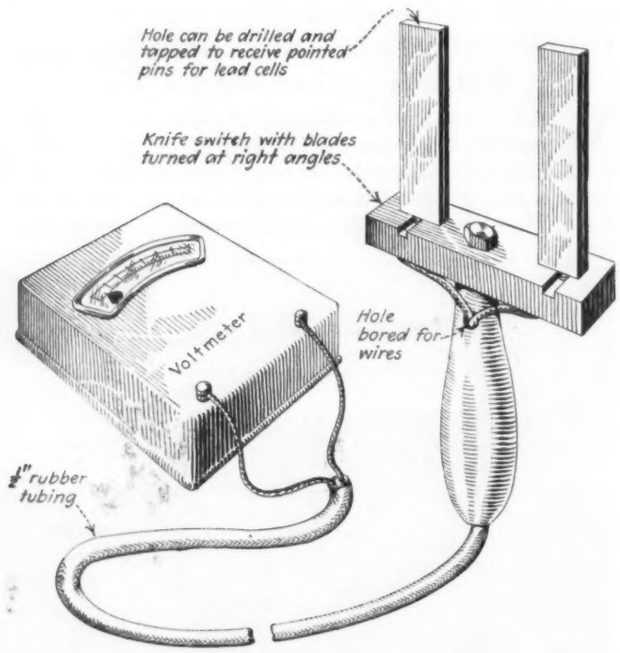
(Ore.) Railway, Light & Power Company sets the transformers in a concrete vat or tub of sufficient size to hold all of the oil contained by the transformers. The vat is provided with a sewer drain to carry away any overflow

of oil that might occur. This arrangement has the further advantage that water may be sprayed on the transformers to keep them cool in case they are overloaded and become too hot. The accompanying photograph shows such an installation of three 500-kva., 11,000/440-volt transformers supplying power to the electrified sawmill of the Inman Poulsen Lumber Company at Portland, Ore.

W. C. HESTON,
Industrial Power Engineer.
Portland Railway, Light & Power Company,
Portland, Ore.

Cell Tester for Taking Voltage Readings with One Hand

IN TAKING the voltage on cells of a storage battery it is desirable to have one hand free for writing down the reading. In order to accomplish this purpose a two-bladed cell tester has been made by the writer which can be manipulated by one hand. This tester is made of a two-pole switch handle with the blades cut off to a suitable length and turned at right angles to the original position. Connection to the voltmeter is made through two lamp cords which are attached under the screws which hold the blade to the handle. The lamp cords are led through a hole drilled in the handle of the switch, and from this point they pass in ½-in. rubber tubing to the voltmeter, as shown in the accompanying illustration. The tester shown is made for use


Hole can be drilled and tapped to receive pointed pins for lead cells
Knife switch with blades turned at right angles
Voltmeter
Hole bored for wires
¼" rubber tubing

ONLY ONE HAND IS REQUIRED TO TAKE VOLTAGE READINGS ON BATTERIES WHEN USING THIS TESTER

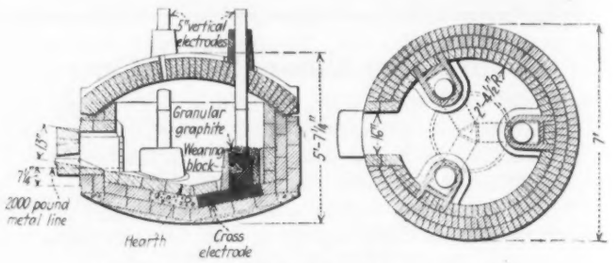
on Edison cells. However, if it be desired, a hole may be drilled and tapped in the end of each blade for holding a steel point which may be used on lead batteries.

This tester allows quicker work than may be done with the two-pointed handles or prods commonly used for taking voltage readings.

FRED A. REIBERT,
Foreman Battery-Repair Department.
American Railway Express Company,
New York, N. Y.

Electric Brass Furnace Shows Small Metal Loss

A METAL loss for yellow brass of less than 1.5 per cent and for red of less than 0.75 per cent brass was shown on tests of two new types of muffled-arc electric furnaces developed by the General Electric Company. These tests were made by this company in its own plant.



MUFFLED-ARC FURNACE WHICH HAS SHOWN VERY LOW METAL LOSS

In one test in which more than forty heats of approximately 70-30 brass were melted the total metal loss by weight, including spillage, dirt and grease in the charge, was only 1.014 per cent.

These furnaces are designed in two sizes, a 1,500-lb. unit and a 50-lb. unit, for melting virtually any nonferrous metal requiring a pouring temperature not above 1,500 deg. C. (2,372 deg. Fahr.). The test showed that the larger furnace melts yellow brass, pouring at 1,100 deg. C., with a power consumption not exceeding 270 kw.-hr. per ton operating twenty-four hours a day with one heat every hour. The smaller furnace melts yellow brass at 1,100 deg. C. at the rate of 100 lb. to 125 lb. per hour with a consumption of 35 kw.-hr. to 40 kw.-hr. per 100 lb., provided that the furnace is heated at the beginning of the run. The power factor for both furnaces is 0.95 or better. The larger furnace takes three-phase energy and the smaller furnace is single-phase.

The 1,500-lb. furnace is equipped with electrode regulators to maintain automatically the desired power input. The whole top of the furnace may be lifted for inspection or repair of the lining without disturbing the electrodes. The diagram shows the interior arrangement of the three D-shaped muffles, wearing blocks, cross electrodes and vertical electrodes which compose the heating elements. The space between the inside wall of each muffle and the electrode and wearing block is filled with crushed graphite to smother the arc. The triangular space where the cross electrodes meet in the middle is filled with a mixture of graphite and tar to insure a good electrical connection.

The 50-lb. furnace is constructed on much the same principle except that in this case the hearth is flat, it being designed to receive standard graphite crucibles. There is also some difference in the electrode and block arrangement, since the furnace is for single-phase operation. A horizontal carbon block, embedded in crushed graphite, extends across the bottom, carrying a wearing block on each end. Between these wearing blocks are four carborundum bricks which form the hearth. Two graphite electrodes extend through the roof to the wearing blocks, the arcs being smothered in the graphite surrounding the blocks. The electrode regulation is entirely manual and is accomplished by adjusting the wheels on the electrode holders. In operation the cruci-

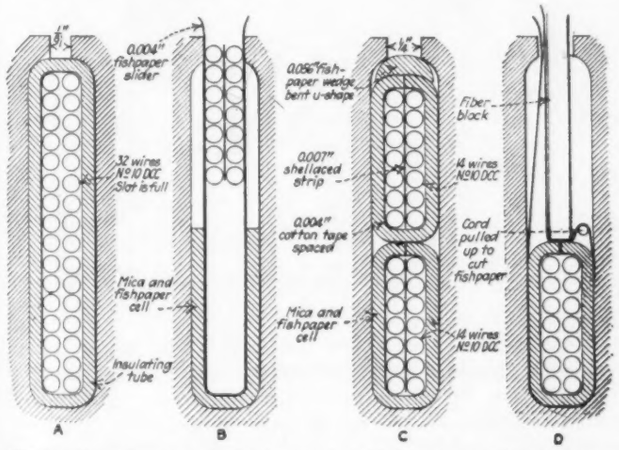
ble containing the metal to be melted is set on the carborundum bricks forming the hearth.

The metal is heated by the same action in both furnaces. The current flows from the vertical electrodes through arcs to the crushed graphite and the wearing blocks. These arcs are smothered by the graphite in the muffles, and the whole mass becomes heated, forming a heat source of large area and uniform temperature. The heat is radiated to the metal from all directions as well as absorbed from the muffles and the hearth. As a result uniform temperature distribution free from hot spots and an atmosphere free from oxidizing gases or other agencies which would contaminate the metal is said to be obtained.

Threaded-in Chain Winding Replaced by Formed Coils

IN A RECENT rewinding job done in a large repair shop an old concentric-chain winding was replaced by formed coils. Although this caused some unusual difficulties, it was decided upon as the easiest method of rewinding. The machine was a 200-hp., three-phase, 60-cycle, 4,400-volt, twelve-pole, 585-r.p.m. old-style squirrel-cage induction motor which had burned out. The stator had 180 slots and 90 coils, one coil per slot, arranged in two ranges, in concentric chain, and connected two-parallel star. The opening in the top of the slot was ⅛ in. wide. There were thirty-two turns of one No. 10 double-cotton-covered wire per coil. The slots were sixteen wires high by two wires wide. There were five coils connected in series per group. This winding had been wound in place by hand. To rewind the stator with the same type of winding was out of the question on account of the time required, so it was decided to change the winding into the two-layer diamond-shape pulled-coil type.

The first difficulty was that the opening in the top



HOW THREADED-IN WINDING WAS REPLACED BY MOUND COIL

A—Old threaded-in winding. B—Slot opening enlarged to ¼ in. and coil slipped in with aid of fishpaper slider. C—Coils in place, 28 wires in slot instead of 32. D—Scheme for cutting off fishpaper.

of the slot was very narrow, ⅛ in. The old winding had been pushed through an insulating tube, as shown at *A* in the drawing, one wire at a time. The slot opening was large enough to pass one No. 10 wire and the wires of the new coils could be threaded in, but this would mean bending wires at the ends of coils and would take much time. There would also be possibilities of crossed wires in the slots. Therefore the threaded-in coil was discarded, and it was decided to grind the slot opening large enough to pass a coil, wound in layers, two wires wide. This coil would have to be held rigid by means of a 0.007-in. shellacked fullerboard strip and 0.004-in. cotton tape spaced and dipped twice in plastic varnish. A 0.004-in. fishpaper slider also was required in the slot to protect the coil while being inserted. This meant that the slot opening had to be the width of two No. 10 double-cotton-covered wires (0.224 in.) + 0.007 in. (shellacked strip) + 0.008 in. (tape) + 0.012 (varnish) + 0.008 (fishpaper), which equals 0.259 in. or about ¼ in. Accordingly the slot was ground with a wheel to this width.

The next problem was to decide type of connection, pitch, turns per coil, etc. The old winding consisted of ninety coils, thirty-two turns per slot, therefore a two-layer winding would require 180 coils, sixteen turns per coil. There being two coils per slot would make thirty-two turns per slot as before. But the two-layer winding requires insulation between top and bottom coils, because the full difference of potential exists between these points in some parts of the winding. As the old winding and insulation fitted the slot tightly, the only remedy was to drop off two turns per coil or four turns per slot, which would give 0.224 in. for a retaining wedge and for insulation between top and bottom coils.

Dropping two turns per coil of sixteen turns would mean a reduction of 12½ per cent, which would decrease the required applied voltage 12½ per cent. As this voltage is too low for satisfactory operation, the motor could not be connected as it was before (in two-parallel star).

A series-delta connection with fourteen turns would, however, make the correct voltage possible. With a two-parallel star connection the voltage was 4,400. Changing this to series star, the voltage would be 8,800. A change from series star to series delta would give 8,800 ÷ 1.73 = 5,080 volts. Decreasing the turns to fourteen instead of sixteen would give 4,445 volts. This is about 1 per cent high and would be perfectly satisfactory. However, the chord pitch might be reduced without materially affecting the voltage. Consequently, in order to save copper and to make a neater job, the pitch was made one-and-fourteen instead of one-and-sixteen, which was the original pitch. A pitch of one-and-fourteen gives a chord factor of 0.978, which decreases the voltage to 4,445 × 0.978 = 4,347 volts. This is sufficiently close to 4,400 volts (about 1.2 per cent less). As the voltages between turns in the new coil would be virtually the same as in the original winding, no extra insulation was necessary.

Accordingly 180 coils were wound on a shuttle with fourteen turns of one No. 10 double-cotton-covered wire, two wide by seven deep, with cross-overs taped. A 0.007-in. strip of shellacked fullerboard was placed between the two halves, as shown in *B*, and the coils were pressed and pulled into shape. The sides were taped with one layer of 0.004-in. x ¾-in. cotton tape spaced. This was extended onto the diamond ends about 2 in. The coils were dipped twice in plaster varnish and baked after dips. Then the coil ends were taped with four half-lapped layers of 0.008-in. x ¾-in. black bias-cut treated cloth tape, sterling varnish being brushed on between layers. The layers were put on so that the thickness of insulation tapered to one thickness which extended 1 in. onto the slot section.

One layer of 0.007-in. x ¾-in. cotton tape half lapped

was put on over the treated tape. The bottom slot section of the coil was made long enough to project 1¼ in. beyond the iron on each side, while the top projected 1½ in. The phase coils had six layers of treated cloth (two extra), and red cotton tape was used on the lead ends to distinguish them from the plain coils. The coils ends were then dipped twice in "Sterling" varnish, care being taken that the varnish did not run onto the slot sections.

The slot insulation consisted of two cells, one for the bottom half of the coil and one for the top, as shown in *C*. Each cell was built up with five thicknesses of 0.015-in. mica and fishpaper. These were cut the full length of the straight part of the slot section and just wide enough to turn over on top of the coil and meet, as shown in *C*. A 0.004-in. fishpaper slider was used, as in *B*, to allow the coil to slide into the mica cell without catching on the edges. When the bottom half of coil was in place, the 0.004-in. fishpaper was cut off flush with the mica cell, the two were bent over on top of the coil and the top mica cell was put in (*C*). A 0.004-in. slider was used in the top as in the bottom. When the top coil was in place the slider was cut off. The mica cell fishpaper was bent over, and a 0.056-in. fishpaper wedge.

Some difficulty was experienced in cutting off the fishpaper sliders even with the top of cells. The slots were too long and narrow to use the regular insulation trimmers and the coils could not be lifted to the top of the slot, because when it was attempted they could not be pushed down again into the cell. Therefore a piece of strong hemp cord 3/32 in. in diameter was used as shown at *D*. A loop at one end was passed over the bolts which hold on the end bells and the string was laid inside the cell on top of the coil from one end of the slot to the other. Then a piece of ⅛-in. hard fiber 8 in. x 4 in. in size was placed with its edge on the outside of the fishpaper. This block was pressed down on top of the paper and the string was pulled up at one side of the block, thus cutting the paper. The block was moved along the slot until the full length of the cell was cut. The secret of this operation is to have a block of such thickness that there is just room between the side of the slot and the block for the string to pass.

The coils were taped one by one as they were put in, from the iron to the diamond ends, that is, around the corners of the cells, with two layers of 0.007-in. x ¾-in. cotton tape half lapped. This was done to seal the mica and fishpaper cells that extended outside the slot.

The motor was rewound for $1,100 less than the cost of a new motor and the delivery date for a new motor was bettered by two months. The new winding was connected series-delta, pitch one-and-fourteen with 180-coils of fourteen turns of one No. 10 double-cotton-covered, five-coils-per-group, top-to-top connection.

Bronx, New York City. C. A. JOHNSON.

Pigtails and Large Number of Brushes Aid in Dissipating Heat

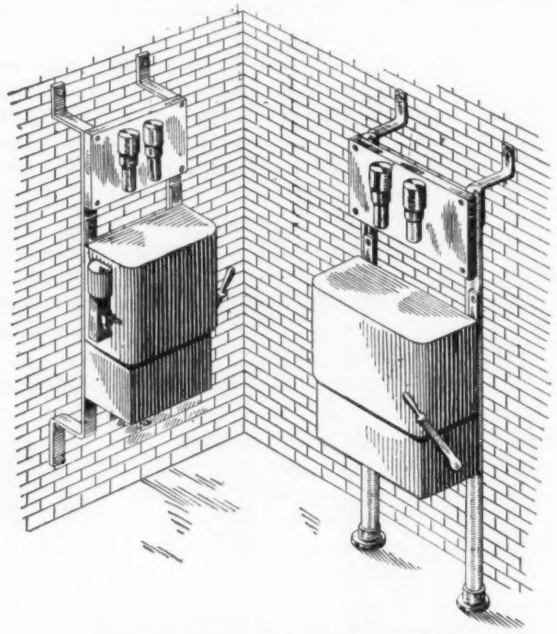
WITH the latest designs in electrical machines of high speed and high current ratings the dissipation of heat losses on the commutator is an important item. A large number of small brushes have a much greater radiating area than a small number of large brushes, and in addition to this a small brush has less inertia than a large one; hence the small brush is more capable of maintaining contact with commutator surface.

Pigtails are a very good path for the dissipation of heat, and brushes should be equipped with more than one pigtail when all possible heat dissipation is required. Under these conditions the omission of any type of pigtail insulation is advisable. Another item often overlooked but relatively important is to be sure that the terminal on the pigtail has sufficient conducting area both on its shank and its contact with the conductor to which it is fastened.

These remarks were made at a recent meeting of the Iron and Steel Electrical Engineers.

Neat Starter Brackets of Strap Iron or Pipe

STARTING compensators mounted on iron brackets are far better looking than those on wooden blocks and there is more room to work behind them. To hold a starter of ordinary size, say up to 50 hp., brackets should be made of flat iron bar ½ in. thick, 1½ in. to 2 in. wide, and in one full length with both ends bent



BRACKETS FOR HOLDING AUTO-STARTERS

At left, bracket for starters up to 50 hp. in size, using ½-in. x 1½-in. strap iron. At right, bracket of 1½-in. pipe for larger starters.

for about 2 in. offset from the wall. The upper and lower ends should be fastened to the wall by lag screws at least ½ in. in diameter and 4 in. long, fitted into expansion shields. If the shields fit the hole drilled for them rather loosely, wedge them in with enough nails to make the lag screws fit tightly. One good feature of this type of bracket is that if all brackets are drilled alike any starter is easily replaced by another in an emergency, using the same bolts and holes. A standard plan can be drawn up and brackets made and kept on hand for any motor job.

For quite heavy starters stands should be built up from the floor and braced out from the wall. Such stands should be made of at least 1½-in. pipe screwed into floor flanges. H. S. RICH.

East Berlin, Conn.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Helping to Locate Street Lamps to Popular Satisfaction

TO FACILITATE expression of opinion by the public as to the proper location of new street lamps the Greenfield (Mass.) Electric Light & Power Company marks on the curbing in yellow paint tentative sites of lamps, and on public ways where no sidewalk exists yellow stakes are put in place. By this means the company's representative is able to ascertain the consensus of opinion in the neighborhood affected and new lights are installed so as to satisfy the majority.

What Constitutes a Desirable Power Customer

HOW a user of central-station power may become an undesirable customer when the cost of serving him becomes excessive was discussed by E. C. Stone of the Duquesne Light Company at the recent meeting of the Pennsylvania Electric Association in Pittsburgh. If a technical analysis be made of the cost of furnishing service under various conditions, a base form will be found, said Mr. Stone, in which form power can be delivered at a minimum cost, and any variations from this form will involve an increase in cost. In the following table he presented the base form indicating the principal variations:

Base Form of Power	*Variations*
Alternating current.	Direct current.
Generated frequency.	Frequencies other than that generated.
Three-phase.	Other than three phases.
Primary voltage.	Other than primary voltage.
Steady.	Unsteady with more or less rapid fluctuations.
Balanced.	Unbalanced.
Unity power factor.	Leading or lagging power factors less than unity.
Ordinary regulation.	Close regulation.
Delivery to point on existing transmission or distribution system.	Delivery to point requiring line extension.
High diversity factor—use of power throughout the year and high load factor.	Low diversity factor—seasonal use of power and low-load factor.
Ordinary continuity of service.	High continuity of service.

Explaining the base form and variations, Mr. Stone continued:

Electric power in the base form described above can be supplied at a minimum cost. Variation from this form involves an increase in cost, the magnitude of which depends upon the nature and degree of the variations.

To furnish direct current or alternating current of frequency other than the system standard ordinarily requires the installation of rotating machinery. The investment, operating losses and operating attention on this machinery add a distinct element of cost to such service. In the rate schedule of one company 30 per cent is added to the energy charge to cover the cost of conversion to direct current. Transformation from standard three-phase to other polyphase systems is simpler and less costly, but it nevertheless involves some additional cost, since such transformers are special and special switching equipment may also be required. If the consumer can use the primary or transmission voltage, the cost of an installation of step-down transformers is saved.

In the basic form there is a steady flow of energy as indicated by constant voltage, current and power factor in the circuit. In general, however, the equipment which utilizes electric power takes a more or less unsteady flow of energy, causing fluctuations of load on the lines and power plant. The tendency of such fluctuation is toward causing trouble in two ways:

(a) On the installation causing the fluctuation, by pulling the voltage down so low that the service becomes unsatisfactory, leading to failure of motors to start and other inconveniences.

(b) On other connected installations, by causing such voltage or frequency disturbances as will render the service unsatisfactory to users in general.

In one case which came to the writer's attention a certain hydro-electric plant was serving a number of textile mills very satisfactorily. The textile mill load being steady, the frequency and voltage of the power system were also steady, giving almost ideal conditions for the operation of the textile machinery. Later on, however, the same system took on a heavy steel mill installation involving rolling mill motors of high capacity. The swinging loads on these motors were so heavy and their magnitude compared to the capacity of the power system was so great that the speed regulation was immediately broken and the service to the textile mills rendered very unsatisfactory.

Fluctuating loads are so numerous and produced by so many types of equipment that no attempt can be made to catalog them here. The important point is that to take care of them involves an additional cost of service in every case where the fluctuations are equal to any considerable percentage of the system capacity.

Balanced load, by which is meant load that is equal on all phases of the primary polyphase system, is a characteristic of the base form of power. The most common form of unbalanced load on a three-phase system is single-phase load, such as lighting units, small furnaces, etc. If the load on a three-phase system is balanced, the capacity of the system is at its highest. Any unbalancing of the phases increases the operating losses and heating.

Effect of Unbalanced Load

Unbalanced load on a polyphase system therefore requires additional investment in substations, lines and generating plant to take care of the greater heating and may require improvement in voltage regulation. There is, therefore, a perfectly real increase in cost in supplying single-phase or other unbalanced loads.

That the capacity of the system is maximum when the power factor of the load is unity is so thoroughly understood as not to require discussion at the present time. It is only necessary to mention the fact that power factors of less than unity involve an additional cost in generators, lines and transformers or in corrective equipment such as static and synchronous condensers. Low power factors may be largely prevented, however, by proper design of power installation and use of the most suitable motors.

In discussing this general subject, the necessity of good voltage regulation on all central-station systems should be emphasized. The apparatus utilizing electric power is extending over a constantly widening field and is becoming more and more exacting in its requirements. Higher

voltage, voltage-regulating equipment and power-factor-raising equipment are the best methods of obtaining better regulation. In general, the addition of copper to the circuit is the most costly method.

These things being the case, the normal regulation of the system will be such as properly to take care of normal service. Where excessively close regulation is required additional equipment must be installed as indicated above, and such additional equipment will involve an additional cost.

It sometimes happens that a consumer who has at one time been taken on a system in an irregular manner because power was available later becomes an excessive-cost consumer because of changes in the system. For example, a number of cases have come to the writer's attention where power consumers were taken on to a 500-volt railway system which afterward became overloaded and thus made it impracticable to take care of other than railway power. This is a situation which should be carefully watched, and the central-station company should not obligate itself to furnish power under these conditions except with suitable limitations. The central-station system aims to furnish a supply of power which is sufficiently continuous to take care satisfactorily of the needs of its average consumers and which is as near being absolutely continuous as such average consumers are willing to pay for. To render service which is subject to less interruption than this requirement indicates involves an additional cost such as the installation of special emergency lines and substation equipment or even storage batteries in certain cases. For many users this excess cost is not warranted. Special provisions for continuous service required by users having special conditions should be paid for by those users.

The object of the foregoing discussion has been to show that electrical energy in some standard form can be supplied at a minimum cost, and that when variations from such standard form are required additional costs are developed. Standard central-station power service is analogous to the standard product of a factory. The cost of the standard product is much lower, but the special product can be furnished if the user is willing to pay the price. If, then, the rate schedule is based on supplying the standard form of energy, the most desirable consumer is the one who takes his energy in that form nearest the standard and the most undesirable consumer is the one who requires energy farthest from the standard form and who, therefore, involves an unduly high cost to serve without yielding a corresponding increase in revenue.

EXCESSIVE COST OF SPECIAL SERVICE

At the present time the excess costs of some types of special service have been provided for in a more or less haphazard way in the various rate schedules of the power companies, but no comprehensive plan has been developed for systematically taking care of the entire situation. The result is that in many cases no incentive is offered to use power in the standard form and many petty disputes arise due to restrictions of various kinds which may be placed about the customer.

The points to "put across" to the consumer are that the supply of power in special forms such as those enumerated actually costs more to furnish than standard power, that it is not fair to make those who use power in standard form bear a share of this excess cost of special power, that power in special forms can be furnished if necessary, provided the excess cost is met by the user, but in many cases it is inherently more economical for the user to modify his installation so as to take power in the standard form than for the central-station company to furnish it in a special form.

It seems desirable, therefore, to develop a rate schedule which will take care of the various special forms in which electric power must occasionally be supplied and which will provide a rate for these various forms commensurate with the cost of serving them.

Such a schedule should be founded upon a base rate covering power furnished in the standard form. To this base rate for standard power a series of corrective factors would be applied for the various special forms of power as outlined above. The corrective factors would be so designed that they would increase the base rate by a sufficient amount to take care of all additional operating costs and to earn the normal return on the additional investment involved in the special service. Such a schedule would put the rate for the various forms of service on a standardized basis, on which the consumer could operate as he desired if he was willing to pay the price. From the technical standpoint there would then be no undesirable customers, since each would pay adequately for the service rendered him and a definite incentive in a lower rate would be provided for all users to make their service conform as closely as possible to the standard. If the rate were properly designed, the result would be such a combination of equipment in customers' installations and on the central-station system as would supply the service required at the lowest possible cost.

This lower power cost would lead, in turn, to additional use of power and open up new fields for its utilization, thereby furthering the prosperity and development of the community and at the same time increasing the business of the central-station company.

New York Company's Advertisements Stimulate House-Wiring Business

TO STIMULATE house-wiring business and at the same time emphasize the desirability of installing an adequate number of convenience outlets the United Electric Light & Power Company of New York is running a series of twenty-five advertisements in the daily

When you wire for electricity
remember the need for light in an often forgotten place—above the kitchen stove! An extra outlet there will help make cooking tasks a great deal pleasanter.
Telephone our Sales Department, Stuyvesant 4080, or consult your local Electrical Contractor for detailed suggestions and estimates of cost.
The United Electric Light and Power Co.
When you wire for electricity
remember that you'll soon be converted to table cookery. Provide a floor receptacle for electric cooking appliances and reserve your lighting fixtures for light.
Telephone our Sales Department, Stuyvesant 4080, or consult your local Electrical Contractor for detailed suggestions and estimates of cost.
The United Electric Light and Power Co.

TYPICAL ADVERTISEMENTS OF THE UNITED ELECTRIC LIGHT & POWER COMPANY'S HOUSE-WIRING SERIES

morning newspapers. Two advertisements which are representative of the series are shown here.

Commenting on their purpose Ralph Neumuller, advertising manager of the company, said:

"Apart from the direct benefits to the local electrical contractors and ourselves, we hope that the influence of the campaign will be more far reaching and create a greater demand upon the industry generally for wire, sockets, fixtures, appliances and other materials.

"As a follow-up and tie-in with the newspaper copy we are sending individual copies of some of the advertisements to our house-wiring prospect lists. This has already proved of considerable benefit and is expected to result in a considerable house-wiring business throughout our territory."

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Comparative Study of Vector Diagrams for Polyphase Asynchronous Motors.—J. MONNIER.—Many tests on the above subject proved that the well-known and much-used Heyland circle diagram is not quite accurate. A similar method arrived at by Grob comes somewhat nearer to actual test results. A corrected diagrammatic vector method, called a polar-diagram, has been devised which gives results that check tests very satisfactorily. This new diagram is really the well-known Kapp transformer diagram, with some changes to make it applicable for motors.—*Revue Générale de l'Electricité*, April 2, 1921.

Three-Phase Induction Motor Drive for Mine Hoists.—P. ESCANDE.—Mines in northern France which were partly destroyed during the war are being reconstructed now on a large scale. Virtually all of these hoists were steam-driven, but they are now rebuilt for electric drive. The question of the proper system was carefully analyzed, and it was found that for medium hauls the wound-rotor, three-phase induction motor was best suited. The different variations of the Ward Leonard system might seem to be more advantageous, but with the development of a special control system all the disadvantages of the induction-motor system are claimed to have been successfully overcome. The article describes in detail the control apparatus built for twenty 430-hp., three-phase induction-motor hoists. A centrifugal regulator prevents a runaway speed of the motor. For rope inspection as slow a speed as 5 in. (13 cm.) per second may be safely maintained by cutting additional resistance into the rotor. Regenerative braking may be used with greater than synchronous speed. Final setting and emergency braking is operated electro-pneumatically.—*Revue Générale de l'Electricité*, March 19, 1921.

Lamps and Lighting

Henri Pieron on the Physiological Principles Underlying the Study of Light.—LEONARD T. TROLAND.—A discussion of an article by Henri Pieron in which he is said to offer a very conclusive and well-ordered summary of modern determinations of the relations between visual sensation and conditions of retinal stimulation.—*Transactions of Illuminating Engineering Society*, April 30, 1921.

Generation, Transmission and Distribution

Graphic Method for the Calculation of High-Voltage Lines.—W. KOCH and W. MAURER.—The authors have developed a very simple and, up to about 200 miles (320 km.), surprisingly accurate graphic method for the determination of the voltage drop, efficiency and power factor of high-voltage lines. The principle of the method is the substitution of an imaginary line, with its capacity concentrated in the middle and half of its resistance and half of its inductance concentrated in each half of the line. A number of concrete examples are calculated with the aid of a great many graphs, and the same examples are also calculated mathematically to show up to which line length the two methods give the same results. Up to 200 miles the results are identical; up to about 500 miles (800 km.) the deviations from the exact values are negligible.—*Elektrotechnische Zeitschrift*, April 14, 1921.

The Economy of Impregnating Wooden Poles.—F. MOLL.—Of the four million wooden poles used annually in America, 90 per cent are white cedar and chestnut, which have, *untreated*, a useful life of about twelve years. In Germany and in most of Europe spruce and pine poles are used almost exclusively, with an untreated useful life of only five years. Impregnation is therefore of utmost importance. The author has investigated its economy and come to the following conclusions: (1) The increase of preserving chemicals improves the over-all economy but slightly, but their decrease causes rapid deterioration; (2) the yearly maintenance cost may be reduced to one-third by proper impregnation; (3) preserving chemicals recommended are: (a) 60 kg. of tar oil per cubic meter wood, (b) 3 kg. to 4 kg. of a mixture of fluor-natrium and phenol per cubic meter wood, applied under pressure, (c) impregnation with 0.66 per cent corrosive mercury (Kyan process), (d) impregnation with 0.66 per cent corrosive mercury and 1 per cent fluor-natrium (improved Kyan process).—*Elektrische Kraftbetriebe und Bahnen*, March 24, 1921.

Unusual Boiler-Tube Corrosion by Carbon Dioxide.—BARZILLAI G. WORTH.—A steam boiler corroded rapidly and resisted all attempts to protect it electrolytically. Finally the trouble was traced to soluble iron bicarbonate in the water used, which gave off large quantities of carbonic-acid gas when heated in the boiler. The water was then treated by being kept at the boiling point eight hours in a preheater, where the carbonic-acid gas was liberated and a sludge of ferric hydroxide precipitated. The trouble then ceased.—From paper presented before American Electrochemical Society, April 21, 1921.

Installations, Systems and Appliances

Electrically Heated Steam Boilers.—REVEL SYSTEM.—Steam is generated by passing the current through the water, using two, three or more axially arranged electrodes. The steam pressure is maintained constant automatically by raising or lowering the water level, thus immersing the electrodes more or less. To avoid electrolytic action alternating current is used. The steam generator discharges its steam into a steam accumulator. Tests on a boiler of 0.18 cu.m. water content consuming 200 kw. gave 1.256 kg. of steam per kilowatt-hour at a feed-water temperature of 10 deg. C. The evaporation efficiency was determined to 95.3 per cent, the thermal efficiency to 95.7 per cent. An average pressure of 6.42 atmospheres was maintained. The boilers can be used on voltages of 200 to 3,600.—*L'Industrie Electrique*, April 10, 1921.

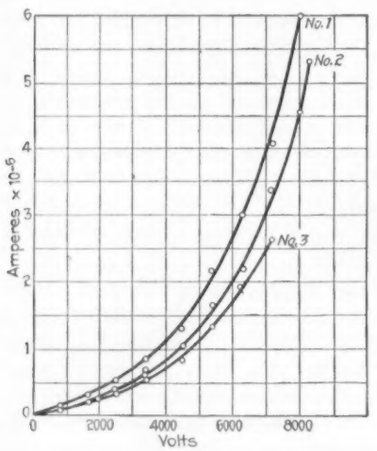
Magnetos for Ignition Purposes in Internal-Combustion Engines.—E. A. WATSON.—The design of magnetos for ignition purposes is discussed and the trend of development indicated.—London *Electrician*, April 22, 1921.

Electrophysics and Magnetism

Piezo-Electric and Allied Phenomena in Rochelle Salt.—J. VALASEK.—Some recent work on the piezo-electric and allied properties of Rochelle salt is described which has brought to light a number of peculiarities in the electrical reactions of this substance to applied forces and electric fields.—*Physical Review*, April, 1921.

Damped Electric Oscillations.—R. B. ABBOTT.—A summary of previous work on logarithmic and linear damping in electric circuits is given. The mathematical treatment of four types of oscillations is then carried out, namely, (1) simple harmonic, (2) logarithmically damped, (3) linearly damped, (4) combined logarithmically and linearly damped.—*Physical Review*, April, 1921.

Conductivity of Insulating Materials Near the Breakdown Voltage.—J. E. SHRADER.—Insulating materials were found whose conductivity (1) obeys Ohm's law throughout, (2) obeys Ohm's law up to near breakdown and then increases at an accelerated rate, and (3) increases over the whole range of voltage at an accelerated rate to breakdown. In general, materials in class 3 have the greatest dielectric strength and those in class 1 the least. Results are given for untreated cement paper, paraffined fish paper and black treated cloth, which were selected as representative, respectively, of the three classes.—*Physical Review*, April, 1921.



CONDUCTIVITY CHARACTERISTIC OF TREATED BLACK CLOTH 0.011 IN. (0.28 MM.) THICK

The Electrical Properties of Glass.—J. R. CLARKE.—A discussion of the insulation resistance, the dielectric constant or specific inductive capacity and the dielectric strength of glass. The qualities which should be characteristic of glass for various special purposes are outlined in the article.—*Beama* (British Electrical and Allied Manufacturers' Association) March, 1921.

Electrochemistry and Batteries

Recent Progress in High-Frequency Inductive Heating.—E. F. NORTHRUP.—A description of the present status of high-frequency oscillating-current furnaces for experimental, laboratory and commercial work. Also of the high-frequency converter sets made for use with them. Furnaces of seven types are described in detail and the actual performances given, showing them to run at 30 to 40 per cent of electrothermal efficiency. The largest furnace described takes 60 kw. and can melt 600 lb. (275 kg.) of silver.—From paper presented before American Electrochemical Society, April 21, 1921.

Symposium on Corrosion of Metals and Alloys.—The various corrosion studies discussed are (1) corrosion of metal roofing—atmospheric corrosion, (2) corrosion of pipes, rods and wires embedded in moist soil, (3) corrosion of boiler tubes and hot-water pipes, (4) corrosion of metals submerged in sea water or acid liquors, and (5) corrosion of metallic anodes. The corrosion of buried lead cables is also discussed.—*Chemical and Metallurgical Engineering*, May 11, 1921.

Units, Measurements and Instruments

High-Voltage Fuse with Current-Limiting Resistance for the Protection of Instrument Transformers.—F. PATZELT.—In plants of high capacity ordinary fuses fail to protect safely instrument transformers, owing to the large surge of current into the faulty apparatus. For voltages up to 50 kv. it has been found that a fine-wire fuse will open safely if the energy is limited to about 1,500 kva. Siemens-Schuckert build such fuses, therefore, using a fine wire embedded in a fireproof powder and inclosed in a glass tube. It is in series with a current-limiting resistance consisting of a wire spiral, wound upon a porcelain cylinder and protected by a coat of enamel. Such fuses have been in successful operation for years in several large power plants.—*Elektrotechnische Zeitschrift*, April 7, 1921.

Telegraphy, Telephony and Signals

Wireless Rapid Telegraphy.—J. BRUN.—To utilize to better capacity wireless stations, especially those in the tropics, where there are numerous disturbances during the day, the author recommends the use of automatic sending and receiving. The messages are first transcribed in perforations on a paper strip and are sent out at a speed of about 200 words per minute, which is ten times faster than by the ordinary key transmission. The reception is made by a photographic registering instrument, similar to an oscillograph, which develops, fixes, washes and dries the message within five minutes. Other apparatus suitable for rapid transmission are the Wheatstone, Creed and Baudot systems. With certain modifications all these may be operated by radio. The article gives a detailed description of the different methods and necessary modifications, including the construction of the perforating machines.—*Radio-Electricité*, March, 1921.

Small Ear Telephone.—L. WEBER.—Primarily for the use of people who are hard of hearing, a radically new telephone construction has been put on the market by Siemens & Halske. The customary standard receiver, which is held to the ear by a steel strap, not only causes painful pressure upon the head but attracts unnecessary attention to the impediment of the bearer. This new telephone might be called rightly the smallest ever built. It measures only about an inch in length, and its open end is to be inserted into the ear, being held there by proper shaping of the end piece. Being of such small dimensions, it was not possible to use an iron membrane for the sound generator. A fine piece of specially treated skin with a tiny piece of iron fastened to its middle serves as a membrane. The voice reproduction is claimed to be excellent, and it is adjustable for maximum clearness; it is called "Phonophor."—*Elektrotechnische Zeitschrift*, March 10, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Appropriations Committee Approves Items in Aid of Exports

QUITE contrary to the usual practice, the committee on appropriations of the House of Representatives has acceded to the request of the Secretary of Commerce and allowed the full $250,000 requested principally to assist the twelve chief export industries of the United States, including heavy machinery and electrical goods. In addition the committee approved the full amounts which Secretary Hoover asked for the Bureau of Standards, as follows: Testing structural materials, $50,000; industrial research, including elimination of waste, $100,000; standardization of equipment, $100,000.

Patent Amendment Proposed

IN THE interest of the national defense and to prevent unwarranted advantages to foreign inventors, Senator Stanley of Kentucky has proposed an amendment to the Revised Statutes providing that any patents issued to foreigners must be put in operation and that production in reasonable quantities must be begun within the continental limits of the United States within two years. Failure to comply with that provision entitles the United States to issue a license which will permit use of the patent.

New England Division Convention Set for New London in Early September

THE New England Geographic Division of the National Electric Light Association will hold its fall convention at the Hotel Griswold, Eastern Point, New London, Conn., from Sept. 6 to 9. Business sessions will begin on the morning of Sept. 7.

New England Power Company to Build Million-Dollar Hydro-Electric Plant

HENRY I. HARRIMAN, president of the New England Power Company, Boston, has announced to the Massachusetts Department of Public Utilities that it is the company's intention to begin preliminary work this year upon a new hydro-electric development in the Deerfield River valley of southern Vermont which will produce from 24,000,000 kw.-hr. to 25,000,000 kw.-hr. annually. This will be chiefly primary power, the plant being built below the Somerset Reservoir near Searsburg. Water will be diverted by a dam, and a 21,000-ft. wooden-stave pipe line will serve the station, where a 4,500-kw. installation operating under 245-ft. head will be made. Transmission lines operated at 66,000 volts will be built from the new plant to the Vernon and No. 5 stations of the company. Later the company plans to build a storage reservoir of 4,000,000,000 cu.ft. capacity above Davis Bridge, which is south of the proposed Searsburg plant location, and this will add 80,000,000 kw.-hr. yearly to the system generating capacity. The estimated cost of the Searsburg development is $1,137,000, and that of the associated transmission line and high-tension construction is $277,021.

Ground Broken for Niagara Hydraulic Power Canal

WORK on the new fifteen-million-dollar power project of the Niagara Falls Power Company at Niagara Falls, N. Y., was started recently when Paul A. Schoellkopf, president of the company, turned the first spade of earth for the hydraulic power canal. Among those who witnessed the ceremony were Lieut.-Col. William Kelley, engineer of the Federal Power Commission, and Col. James G. Warren, engineer in charge of the Great Lakes division. Building of the tunnel is only part of the project. When the improvements are complete the Niagara Falls Power Company will generate 450,000 electrical horsepower under one roof.

California Electrical Rates Reduced by Another 4 per Cent

DECISIONS in the surcharge cases of the Pacific Gas & Electric Company and the Great Western Power Company announced by the California Railroad Commission on May 27 make a further reduction of 4 per cent in the electric rates of both companies in addition to the 5 per cent reduction already provided in the temporary order of April 10. This total reduction of 9 per cent leaves in effect only 6 per cent of the original 15 per cent surcharge. The decision is retroactive to April 10, the date when the original surcharge expired and the temporary reduction to 10 per cent was made. That 10 per cent was then ordered impounded and 4 per cent of it will now be returned to consumers.

The decision, written by Commissioner Chester H. Rowell, points out that the electric rates now provided are only 22 per cent in excess of those in the same territory in 1916, though oil prices have in the meantime risen 150 per cent and the costs of other commodities used in the operations of the companies are in general 50 per cent above pre-war prices. Commissioner Rowell points out that these companies were held down strictly to the fair return basis even during the period when other industries were generally making greatly increased profits, and they should therefore not be pressed below that level at this time. A careful analysis of the estimated revenues and expenses of the companies shows that a complete removal of the surcharge would deprive the companies of a fair return, but that with efficient management they can make such a return with

a 6 per cent surtax. Proceedings are now pending for a complete valuation of the properties and business of both companies and a determination of more permanent rates based on that valuation. The old rate plus the reduced surcharge will apply until the determination of the main cases.

The Pacific Gas & Electric Company's statement of operating expenses for 1920 showed an actual net revenue of $9,181,860 available for return and depreciation. Had the 15 per cent surcharge been retained during 1921 the net revenue would have been $10,328,353. The new order shows that the commission estimates that the basic rates of the company plus the 6 per cent surcharge will produce a gross revenue of $23,028,000 and a net of $9,979,190, of which $1,594,055 is for depreciation.

Farm Bureau Urges Completion of Muscle Shoals Dam

AN INVESTIGATION of the whole Muscle Shoals project has been made by a special committee of the American Farm Bureau Federation, and its recommendation that the Wilson Dam at Muscle Shoals be completed by the government without continued delay and that the air-fixation nitrate plants be placed under the direction of a governmentally owned corporation which may in its discretion operate the plants or maintain them ready for operation, but with strict regulations relative to prices to be obtained for commodities in which the products of these plants are used, has been approved unanimously by the executive committee.

Representative Graham, who is against the Muscle Shoals project, has introduced a bill authorizing the Secretary of War to lease the dam and nitrate plant No. 2 for a period not to exceed twenty years to any co-operative agricultural association or corporation. The lease is to include the steam power plant and may be extended so as to empower the lessee to complete the dam.

The Chief of Engineers has been instructed by the Secretary of War to ascertain if any power companies would be interested in entering into a contract with the government to take over power which would be generated at Muscle Shoals in case the dam were completed.

Activities for Engineers Indorsed by A. A. E.

MEMBERS of the American Association of Engineers went on record at the annual meeting at Buffalo, N. Y., recently, as indorsing the following stands in matters affecting the activities of engineers: Favoring an engineer on the International Boundary Commission; favoring a national board of classification for engineering schools; against laws permitting corporations to practice as engineers; favoring a census of highway traffic; favoring a continuance of federal aid to highways; favoring Phipps bill increasing federal aid allotment in public land states; favoring national financing of reclamation work; favoring sanitary engineers on public boards of health; favoring a minimum of two weeks' notice by both parties in case of separations in employment, and providing for a committee to plan employment service and payment therefor.

It was directed that advance copies of annual convention reports be prepared. The officers elected for the ensuing year were: President, H. O. Garmon, chief engineer and consulting engineer with the Indiana Public Utilities Commission; first vice-president, A. N. Johnson, dean of engineering at Maryland State College; second vice-president, A. S. Morris, auditor, capital expenditures, Chicago & Northwestern Railroad; directors, E. F. Ayres, Webster L. Benham, Garrison Babcock, Morris Bien, G. M. Butler and W. R. McKeen.

Dr. George Otis Smith Urges Ample Coal Reserves for Utilities

"CLEARLY the public utility operator has everything to gain and nothing to lose by continuing to maintain his reserves. It is increasingly plain that the condition of consumers' stocks has a very profound bearing on the coal market. When a man has a large stock he can wait for favorable terms. When his stock is small he has to buy. If something happens to interrupt the orderly flow of coal from mine to place of use he has to buy emergency coal. Now, when stocks are generally low a sudden interruption to supply—a blizzard, a switchmen's strike, a traffic jam—finds many consumers unprepared and drives them to enter the spot market. That is the time when a well-stocked coal bin pays for itself. That plant is equipped to withstand a siege."

In these words Dr. George Otis Smith of the United States Geological Survey, replying to a request from John W. Lieb, vice-president of the New York Edison Company for an expression of opinion as to whether public utility companies should conclude contracts for coal at present, expresses his views on the importance of such companies keeping their bins stocked. To Mr. Lieb's question as it stands Dr. Smith does not return a categorical answer, but as bearing directly on the subject he gives statistical data from the Geological Survey's weekly coal report concerning the stocks of coal carried by electrical utility plants on April 1. These data show that the public utilities were then in probably the strongest position of all coal consumers.

Expressing the view that a coal stock above ground of from 30,000,000 tons to 40,000,000 tons constitutes the "critical level" above which there is a buyers' and below which there is a sellers' market, Dr. Smith proceeds:

"Now, what is the present level of stocks? The Geological Survey's inventory showed that on Jan. 1, 1921, it was not more than 48,000,000 tons and not less than 42,000,000 tons—say about 45,000,000 tons. By April 1 stocks had dropped to somewhere near 37,000,000 tons, and since then they have doubtless decreased further. In other words, while we can tell from the tone of the market that the critical level has not yet been touched, it is plain that stocks are fast approaching it, and that it would be unwise from the consumers' point of view to let them sink much lower."

Danger of a congestion of coal transportation under heavy peak loads occasioned by a revival of business is not a thing of the past and forms another argument for abundant storage. "With adequate stocks," Dr. Smith concludes, "the public utility is and will be in a strong position to buy, whatever the level of costs and whatever the market position of other consumers. The public utility cannot shut down, and the public must pay for the coal the public utility buys; hence from the public standpoint the double function of large stocks—to keep up service and to keep down prices."

Mechanical Engineers Discuss Middle West Power Development

ENGINEERS can accomplish more by concentrating on the power problem in their own locality than by devoting time to the general problem of super-power projects. This was the opinion expressed by Samuel Insull as chairman of the power session at the convention of the American Society of Mechanical Engineers in Chicago on Thursday, May 26. Much of the criticism and hostility to the development of huge power systems has been due, the speaker held, to the lack of understanding of the fundamental economic foundation on which electric power generation and distribution is built and to the feeling that such systems are only another type of big business combinations. The prejudices of the mechanical engineer, due to pride in his own work of plant construction and in some measure to pure personal interest, were said by Mr. Insull to be hindrances that have retarded development of larger systems. It took the war movement in Great Britain, which based its reasons for combining power sources and systems on American figures and practices, to convince Washington that concentration is necessary. The location of steam plants at the mine mouth was questioned as an economic measure because of the danger in tying up to a single fuel source subject to complete domination by labor organizations and because of the lack of adequate and proper water supplies at such locations. Mr. Insull stated that there are only two or three such locations having water available in the State of Illinois.

W. L. Abbott outlined the location of the principal central power distribution sources in the Middle West, calling attention to the comparatively small amount of high-tension transmission between Pittsburgh and the territory lying east of the Missouri River. The high-tension transmission, except around Pittsburgh, is principally in the southern peninsula of Michigan, around Minneapolis and St. Paul in both Minnesota and Wisconsin, in southern Wisconsin and between Keokuk and St. Louis, with a small amount in Ohio. The largest part of the territory, Mr. Abbott said, has warranted only the lower range of transmission voltages, but in time these systems will merge into large systems that will cover entire states and become interstate in character.

C. W. Place in discussing future power development in the Middle West showed that the fact that only 15 per cent of the oil production of the United States was from that section precluded the possibility of oil cutting a large figure in power production there. With coal as a fuel steam-electric generating plants will form the main source of power.

Serious consideration of the progressive development of streams on a low-head basis, with automatically controlled plants, to make the best possible use of hydro-electric power to supplement steam generation was proposed. Hydro-electric power was indicated as largely a peak-load resource because of the limitations imposed on storage by the cost of overflow lands on the river bottoms.

In the discussion the utilization of coal to obtain its by-products before its use in producing steam was suggested for serious study. Mr. Insull closed the discussion by showing that interconnection in the Middle West is proceeding along economic lines. The necessary lines are being constructed as there is real reason for them. On such a foundation alone can interconnection be a success. Mr. Insull also asserted that no one should be allowed to produce energy when it could be purchased more cheaply and that in place of depriving commissions of the power to regulate they should receive more drastic powers in order to prevent economic blunders.

On Tuesday a session devoted to fuel discussed the capacity, efficiency and limitations of mechanical stokers in the utilization of Middle West coals. H. B. Reynolds discussed efficiency tests of a 30,000-kw. steam turbine at the Fifty-ninth Street power station of the Interborough Rapid Transit Company in New York. On Wednesday W. M. White of the Allis-Chalmers Company presented a full discussion of the hydraucone regainer and its development.

Testimonial Dinner to J. M. Wakeman

A DINNER in honor of James M. Wakeman, the retiring general manager of the Society for Electrical Development, was given on the evening of May 26 at the McAlpin Hotel, New York, by present and former members of the staff. Formalities were barred, but, led by Harry Alexander, former director of publicity for the society, those present united in expressing their sense of the value of the experience gained under Mr. Wakeman's leadership, which had been a source of inspiration to them, and in extending to him their heartfelt good wishes. It was felt that, though he has severed his active connection with the society, he will always remain a potent factor in its work and that the ideals he set in the formative period of the society constitute a solid foundation upon which the organization can rest and expand.

At the conclusion of the dinner Theodore Dwight, on behalf of the staff, presented to Mr. Wakeman a loving cup inscribed: "To 'J. M.'—An Appreciation from Associates in the S. E. D."

Federal Power Commission Approves Amended Regulations

THE Federal Power Commission, meeting in special session May 27, approved the amendments to the regulations promulgated for the administration of the water-power act, with the exception of the proposed multiple in the specified rate of return and the regulation dealing with the allocation of earnings. The commission affirmed the multiple 1.5 and approved a revised form of the existing regulation on allocation which allows permittees or licensees to propose a basis of allocation before the issuance of a permit of license but subjects such a basis to review at not less than five-year intervals.

The commission also gave approval to an additional paragraph to Regulation 20, which requires licensees to file copies with the Federal Power Commission of annual reports made to the state commissions or to their stockholders.

The application of the Arkansas Hydro-Electric Company was denied because the Chief of Engineers reported that the Little Red River is navigable at and above the site at which it is proposed to build the dam. Another reason for denial of the application was that public lands are involved.

North Central Geographic Division Arranges Its June Program

THE general relations between telephone and electric companies in the matter of construction and operation of lines will be discussed during the annual convention of the North Central Geographic Division of the N. E. L. A., to be held June 21, 22 and 23 at Duluth, Minn. Addresses on the subject will be given on June 22 by A. A. Gantt, chief engineer of the Northwestern Bell Telephone Company, Omaha, Neb., and by a representative of the Tristate Telephone & Telegraph Company of St. Paul.

At the business sessions on June 23 F. R. Winders of the Railroad Commission of Wisconsin will read a paper on "Rural Electric Lines," and W. T. Delihant, Jr., fuel agent of H. M. Byllesby & Company, Chicago, will address the convention on the subject of "The Fuel Situation." A paper on "Coal Economy in Small Steam Plants," by J. J. Brennan, engineer of tests for the Northern States Power Company, Minneapolis, will follow. There will also be addresses by officers of the National Electric Light Association. A large number of entertainment features have their place on the program.

Southwestern Men Discuss Power Factor and Electrical Merchandising

THE poor power factor of customers' loads was characterized as the fault of the central station by E. B. Speer of Dallas in a paper on "Power-Factor Meters and Measurements" presented before the Southwestern Electrical and Gas Association, which met at Galveston, Tex., May 18-21. Mr. Speer called attention to the importance of seeing that customers buy motors of the size actually needed rather than for future developments. He favored applying charges for power factor to the energy portion rather than the maximum-demand portion of the rate. In the discussion that followed considerable preference for measuring the power factor of a customer's load by two single-phase wattmeters was expressed.

That the central station that does not carry on a merchandise business is going backward was the opinion expressed by K. E. Mason of Terrell, Tex., in discussing the subject of electrical merchandising. With attractive salesrooms and a carefully worked-out sales policy such merchandising was believed by Mr. Mason to be a business builder for the central station. Vance Porter of Bay City, Tex., advocated the use of electrical merchandising as a means of raising the kilowatt-hour revenue of the average consumer, citing the success of the Texas Public Service Company in raising residence lighting revenues from $2 per month to $4 and $5 by the sale and use of electrical appliances. J. C. Kennedy of the American Public Service Company, Dallas, told of the possibilities of keeping appliances in service by following up consumers and ascertaining whether appliances owned were in proper repair.

Ex-chairman Busby of the Missouri Public Service Commission declared that the causes for public hostility to the utilities are past. Criticism of state utility commissions had been largely caused by the courage of commissions in adjusting rates upward under war conditions.

Judge M. H. Gossett, president of the federal land bank, Houston, in discussing the utility problem from a banker's viewpoint, asserted that the pecuniary interest of voters in the settlement makes any determination of utility matters by popular vote a travesty. The consumer has grown to accept service as a matter of course and must be educated to understand what is involved in labor costs and financial expenditure. The speaker favored the establishment of a commission for Texas. The establishment of such a commission was also advocated by W. B. Head, vice-president of the Texas Power & Light Company, who favored a form of joint control of utilities by the municipalities and a state board.

Officers for the coming year were elected as follows: President, C. E. Calder; first vice-president, Alba H. Warren; second vice-president, S. R. Bertron, Jr.; third vice-president, John W. Carpenter.

Illinois Utility Bill Passes House

THE utilities bill now before the Illinois Legislature passed the House last week by a vote of 100 to 23. It had been expected that the measure would be beaten in the House, but it was jammed through as an administration measure. The bill, which has been heralded as carrying out Governor Small's pledge to abolish the present utilities commission, was outlined briefly on page 1123 of the May 14 issue of the ELECTRICAL WORLD. Although it reduces the salaries of the individual commissioners, it increases their number and adds assistants until the total salary list is about doubled. A hot fight against the bill is looked for in the Senate, and a public hearing before committee is expected to be granted by that body.

Western Society of Engineers Protests Against Illinois Commission Bill

PROTEST has been made to the Governor and the General Assembly of Illinois by the Western Society of Engineers against the pending bill changing the organization and functions of the Public Utilities Commission of the state. The board of direction of this society asserts its belief that the proposed act would be a very harmful piece of legislation. It would result, the board holds, in endless confusion, including conflicting jurisdictions and, in some cases, no regulation at all. It would abolish all safeguards over civil service and give the commissioners much less to do, while at the same time more than doubling the total salaries of the commission. An analysis of the bill made by the public affairs committee of the society concludes:

"It is misleading in its provisions. It is a return to the unsatisfactory former utility regulation, or lack of regulation, and practice. It places in the hands of the administration a large appointive power without civil service restrictions. The change in name would permit the wholesale discharge of the present technical staff of the commission, under the guise of abolishing the office, and the substitution therefor of untrained, inexperienced employees for political purposes. It would disrupt any standard of service or rate and would render of little value the investments of thousands of citizens in the present utility corporations. In place of safeguarding these investments and increasing the state-wide regulation, it would permit it to disintegrate into uneven and chaotic conditions. The pretense of abolishing the utility commission is not borne out by the proposed law."

Safety Men Find that Electrical Hazards Are Reduced by Proper Design

ELECTRICAL hazards in generating stations and substations will be greatly reduced by proper consideration of safety features at the time the equipment layout is made, according to M. M. Samuels of the J. G. White Engineering Corporation, speaking at the May 27 meeting of the American Society of Safety Engineers in New York, at which electrical hazards were discussed. The plentiful use of signal lamps at each piece of apparatus to indicate whether the equipment is alive or dead was recommended by Mr. Samuels. Furthermore, he believed that hook-type disconnecting switches should be eliminated and mechanically operated switches used. It has also been found advisable to have push-button switches, in series with the control circuit, mounted on oil switches so that a repairman working on an oil switch can open the control circuit.

C. O. von Dannenberg, also of the J. G. White Company, pointed out that on distribution lines plenty of climbing space should be allowed, back arms should be placed to allow clear working spaces and pole steps should be used on all poles where climbing is frequently necessary. In discussing transmission lines he stated that lines should be positively grounded with some form of clamp and by the use of flexible leads rather than with the old chain method. Here also the use of hook-type disconnecting switches was discouraged.

Motor applications are rapidly developing along lines that reduce electrical hazard to the operator, stated L. E. Smith of the General Electric Company.

Chicago's Licensing Ordinance Is Redrafted

A NUMBER of changes have been incorporated in the latest draft of the proposed municipal ordinance to license and regulate the sale and installation of electrical appliances in Chicago, which was noted some time ago in the ELECTRICAL WORLD. The changes were made in response to requests of various electrical interests in the city, but the opposition aroused by the original draft of the ordinance has not entirely died down. A hearing before a joint sub-committee of the committee on gas, oil and electricity and the committee on revenue was arranged for June 2, at which the city and the electrical interests were to endeavor to come to an agreement.

Among the most vital of the changes made is one which specifies that the Commissioner of Gas and Electricity will accept the tests of certain recognized testing bodies as to the safety of any appliance. In the first draft this matter was left entirely to the discretion of the commissioner. The new ordinance also limits licensing and regulation to retail business, whereas the original one could have been construed to control any local business house engaged in selling electrical appliances. The license fee has been increased from a flat fee of $50 to one of $50 where fewer than six clerks are employed and $5 for each clerk above that number. The preliminary testing fee has been cut from $5 to $1, but the person or company applying for test will still pay all expenses of having the test made. The new draft also provides for a fine of 20 per cent of the amount realized by the sale of any appliance which on account of changes in construction should have been resubmitted to the commissioner for test. That section of the first draft providing for re-examination once a year of all appliances has been stricken out.

Electric Light and Power Company Issues for May Break All Records

SINCE the beginning of the year there has been a decidedly marked general upward trend in the amount of financing of electric light and power utilities. May, 1921, has been, however, the banner month and has set a new record with its flotation of $55,375,475. This unprecedented total almost doubles that of last month as well as that of a year ago. It exceeds the total for January, 1921, which was also a record month, by $14,791,475, and makes the issue of October, 1920, $38,295,300—the highest of last year—seem small in comparison.

The average yield, 7.71, is slightly less than that of last month. Long terms and large single issues predominate, the periods ranging from not less than five to as long as thirty years. The largest single flotation is that of the Duquesne Light Company, which offers $10,000,000 in fifteen-year convertible gold debentures at 98.5, to yield 7.85.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered at
Connecticut Light & Power Co.	$6,500,000	30-year	First and refunding mortgage sinking fund gold bonds, series A	Retire floating debt—future construction	7	7.40	95
Milwaukee Electric Railway & Light Co.	5,000,000	20-year	Refunding and first mortgage gold bonds, series A	Reduction of floating debt	7.5	8	95
American Power & Light Co.	3,500,000	20-year	Secured gold bonds	Refunding	8	8.15	98.5
Portland Railway, Light & Power Co.	4,500,000	25-year	First lien and refunding mortgage gold bonds, series A	Acquisition of property—current working capital	7.5	7.85	96
Duquesne Light Co. (Pittsburgh)	10,000,000	15-year	Convertible gold debentures	Acquisition and extension of properties	7.5	7.65	98.5
Niagara Falls Power Co.	6,000,000	30-year	First and consolidation mortgage gold bonds, series A A	Refunding and new construction	6	7	88
San Diego Consolidated Gas & Electric Co.	2,750,000	18-year	First and refunding mortgage gold bonds	Future construction	6	7.30	87
Durham (N. C.) Public Service Co.	500,000	15-year	General mortgage sinking fund gold bonds series A		8	8.25	98
Little Falls Water Power Co.	157,000	12-year	First refunding mortgage serial gold bonds of 1916	Refunding	6	7.75	90
Cumberland County Power & Light Co.	600,000	5-year	Collateral trust bonds	Retirement of outstanding notes	8	8	Par
Kansas City Power & Light Co.	6,000,000	.....	First preferred stock		8	8	Par
Philadelphia Electric Co.	5,000,000	.....	Cumulative preferred stock	Reduction of floating debt	8	8	Par
Monongahela Power & Railway Co.	4,580,275	.....	Cumulative convertible preferred stock		6	7.90	19 (par 25)
Washington-Idaho Water, Light & Power Co.	200,000	5-year	First mortgage gold notes		8	8	Par
American Public Service Co.	88,200	.....	Preferred stock		7	8	87.50
Total	$55,375,475						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

One Central Station to Serve a Whole Province.—If a bill now before the local Legislature becomes law all of Prince Edward Island, the smallest of the Canadian provinces, will receive electric service from one central plant to be owned by the Prince Edward Island Light, Heat & Power Company, which seeks incorporation with a capital of $2,000,000. Prince Edward Island has a population less than 100,000 and an area of 2,184 square miles. It is now served by three small electric light and power companies.

Summer Engineering Course at University of Illinois.—A large registration is indicated for the intensive short course to be given from June 13 to June 18 by the department of electrical engineering of the University of Illinois at Urbana, co-operating with the Illinois State Electrical Association. This course will be attended largely by employees of various public utility companies of the state, and in addition to the university faculty meter experts from some of the larger utility companies will be present to give lectures and demonstrations to the summer students in attendance.

Engineering Students in Germany.—According to the London journal *Engineering*, the technical high schools of Germany are overcrowded, the aggregate number of students for the winter term of 1920-21 having been 19,891, as compared with 12,200 before the war and about 5,000 thirty years ago. Electrotechnical students number 3,229, against 1,300 at the beginning of the war, civil engineering students 3,111 as against 2,767, mechanical engineers 6,540 as against 3,100. Mining engineers have shown a comparatively small increase. The largest attendance at any one school was credited to the Charlottenburg institution—3,209.

Thirtieth Anniversary of Kansas School of Engineering.—The thirtieth anniversary of the organization of the School of Engineering at the University of Kansas was recently celebrated by a "conference on engineering activities in Kansas" by visiting engineers and an elaborate "Engineers' Day" program by the students. The conference turned largely into discussion of electrically driven trucks and highway maintenance. This school was built up under the direction of the late Dean F. O. Marvin. It has graduated almost a thousand students. At present the enrollment is 635 in the departments of civil, electrical, mechanical, mining, chemical and architectural engineering.

Electrical League of Cleveland Compiles Directory.—A directory containing the names of 773 companies in the Cleveland district engaged in manufacturing has been compiled by the Electrical League of Cleveland. The directory contains the following information: Main office address, location of factory, office telephone number, names of factory executives and articles manufactured by each of the companies listed.

Construction Begins on Arkansas Power Plant.—Under present conditions electric power will be available from the first plant of the Arkansas Hydro-Electric Development Company, on the Little Red River near Judsonia, before the first of the new year. The first dam, now under course of construction, will, a dispatch to the *Manufacturers' Record* says, cost approximately $1,500,000. It will be 80 ft. high, 450 ft. long, with a thickness of 58 ft. at the base tapered to 8 ft. at the top. It will create a lake with sufficient power to develop 15,000 kw. an hour. Ultimately it is planned to erect other dams and establish plants on streams available for the purpose throughout the state.

Hydro-Electricity in Norway.—In Norway, which has always had prominent rank among European nations utilizing water power, many new power stations have been built in the last few years, writes a European correspondent of the ELECTRICAL WORLD. The production of nitrogen alone requires 400,000 hp. In 1920 the paper mills used ten times more water than steam power. In 1922 the electrification of the most important railway of the country, the Christiania-Drammen line, will be completed. In the neighborhood of Christiania alone the following hydraulic power stations are under construction: Tunhövel, 75,000 hp.; Mörkfossen, 15,000 hp.; Hakovik, 15,000 hp., and Nore Falls, 100,000 hp.

Financial Statement of Ontario Hydro-Electric Power System.—According to a financial statement just prepared, the Niagara system of Ontario hydro-power municipalities has accumulated reserves amounting to $13,874,799, which is less than a million dollars short of the $14,745,499 total advanced by the Ontario government to the municipalities in order to carry through the project. In the statement of assets and liabilities it is shown that the commission's own plant is valued at $14,745,499, municipal plant systems and others are valued at $30,766,611, and the Ontario Power Company's plant and other assets at $28,306,583—a total of $73,826,694. Liabilities are: Advances by the Ontario government to municipalities, $14,745,499; municipalities' debenture debt and other liabilities in respect to local systems, $18,640,645; Ontario Power Company's debentures, $26,567,750—a total of $59,953,895. Reserves are thus apportioned: Sinking fund, plant renewal and other reserves, $11,075,476; surplus, $2,799,323; total, $13,784,799.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Society for Testing Materials.—This society will convene at Asbury Park, N. J., on Monday to Friday, June 20-24.

New York Electrical Society.—The annual meeting of this society for the election of officers was held last night (June 3), when these nominations were made by the nominating committee: For president, C. G. Young; for vice-presidents, F. B. Colt, Ernst Woltmann, O. A. Kenyon; for secretary, George H. Guy; for treasurer, T. F. Honahan.

June Meetings of N. E. L. A. Divisions.—Following the national convention at Chicago, four geographic divisions of the National Electric Light Association are scheduled to hold their annual conventions in June—the Pacific Coast Division at Del Monte, Cal., on June 7-9; the North Central Division at Duluth, Minn., on June 14-16; the Northwest Division at Portland, Ore., on June 15-18, and the Canadian Electrical Association at Quebec on June 15-17. The Iowa Section will meet at Lake Okoboji, Iowa, on June 22-24. Thus, with the annual convention of the A. I. E. E. at Salt Lake City and the A. M. E. S. at New London, Conn., June will be a busy month in electrical circles.

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A., Pacific Coast Division—Del Monte, Cal., June 7-9. (For program see issue of Jan. 29, page 278.)

N. E. L. A., North Central Division—Duluth, Minn., June 14-16.

National Fire Protection Association—San Francisco, June 14-16.

N. E. L. A., Northwest Division—Portland, Ore., June 15-18. (For program see issue of May 21, page 1180.)

Tri-State Water and Light Association—Asheville, N. C., June 15-16.

Canadian Electrical Association—Quebec, June 15-17. (For program see issue of May 28, page 1265.)

California State Association of Electrical Contractors and Dealers—Santa Cruz, June 16-18.

American Society for Testing Materials—Asbury Park, N. J., June 20-24.

A. I. E. E. Annual Convention—Salt Lake City, June 20-25. (For program see issue of April 30, page 1009.)

National District Heating Association—Cedar Point, Ohio, June 22-24. (For program see issue of May 7, page 1069.)

N. E. L. A., Iowa Section—Lake Okoboji, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ontario, June 23-25.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 27-30.

Ohio Electric Light Association—Cedar Point, Ohio, July 12-15.

National Association of Electrical Contractors and Dealers—Buffalo, July 18-22. (For program see issue of April 30, page 1010.)

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Implied Obligations of Public Service Corporations.—When a public service corporation obtains the privilege of occupying and using the streets for a particular public service beneficial to the people of the city, and there is no express contract defining its duties and obligations, the Court of Appeals of Kentucky has recently declared, in Humphreys vs. Central Kentucky Natural Gas Company, the law will raise an implied and enforceable contract to take the place of the omitted express contract, and impose on the company the obligation to render the service that was reasonably within the contemplation of the parties when the contract was made. (229 S. W. 117.)*

Duty of Public Utility Company to Trespassing Child. — A verdict for the defendant company was, the Supreme Judicial Court of Massachusetts has determined, rightly ordered in Adamowicz vs. Newburyport Gas & Electric Company, where the father of a child who died from burns caused by the dumping of hot ashes upon his bare feet in a lot owned by the company sued for damages. The child, as the plaintiff's counsel admitted, was a trespasser, and the court held that there was no evidence of the "gross and wanton negligence" that in such a case would alone permit recovery, inasmuch as it had not been proved that the driver of the truck from which the ashes were dumped had willfully injured the child or had realized that he would not keep out of the way. (130 N. E. 388.)

Liability of Company for Death by Drowning Due to Opening of Its Dam Gates.—In Prondecka vs. Turners Falls Power & Electric Company damages were accorded in the trial court to relatives of two boys who were drowned because of the opening of the gates of a dam owned by the company while the boys were fishing or bathing in the Connecticut River just below the dam. The Supreme Judicial Court of Massachusetts has sustained exceptions filed by the defendant to the charge of the judge in the lower court, holding that he should have directed a verdict in the company's favor on the charge of "wanton and reckless" conduct and that, upon the counts as submitted, the plaintiffs could not recover except upon proof of such neglect as would entitle a trespasser, or at best a licensee, to prevail. (130 N. E. 386.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Remedies Before Public Service Commission Must Be Exhausted Prior to Appeal to Courts.—In vacating an injunction granted by a Supreme Court justice to the city of New York in an action to prevent the New York Edison Company and the United Light & Power Company from increasing their rates in accordance with an adjustment based on the price of coal, the Appellate Division held that the city was without right to bring action in the courts until it had exhausted its remedies before the Public Service Commission. The municipality, the decision held, though it had no interest as a consumer, the schedules complained of not being applicable to it, had the undoubted right to be the complainant in the general interest of the public. However, the plaintiff had an adequate remedy at law expressly provided for it of which it had not availed itself. "There is no reason to suppose," the Appellate Division remarked, "nor is any suggested, that the Public Service Commission would not do its duty when called upon according to law. It is not the province of the court to interfere with the regulatory and administrative work of the Public Service Commission. The court should only act when the commission itself has acted or omitted to act contrary to law." (See ELECTRICAL WORLD for May 7, 1921, page 1063.)

Refusal of Service Where Amount Due Is in Dispute.—In Carpenter Steel Company vs. Metropolitan Edison Company the defendant had threatened discontinuance of service because of plaintiff's refusal to pay the bills rendered unless the supply company continued to furnish bonds to refund any surplus payment which might be found to have been made when rates in dispute and superseding prior contract should finally come to be fixed by the Pennsylvania Public Service Commission. The powers of the commission in the matter were not questioned, but only the equity of the situation as between the parties to the suit. The United States Court for the Eastern District of Pennsylvania condemned the defendant for refusing to submit the justness of its claim to judicial decision and resorting instead to a "strong-hand extrajudicial remedy" which, the plaintiff claimed, abrogated an agreement not to shut off power. The court found no merit in the contention that the published rules and regulations nullified this agreement. "The amount of the debt could have been determined," it said, "by a simple expedient in this very proceeding. All that was necessary was that the defendant file an answer by way of a cross-bill, averring what the sum due was and praying for this to be decreed. As the sum due would thus be found, the court would not restrain the defendant from the collection of a debt thus found to be due and payable. The same finding of what was due could be made in an action brought in any court having jurisdiction." A decision in accordance with this opinion was rendered. (270 Fed. 255.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Extension of Service to Unprofitable Locality. — The Pennsylvania Public Service Commission has refused to order extension of service into sparsely settled localities where such extension would produce a return so low as to unduly burden other consumers.

Utilities Entitled to Fair Return Even in Periods of Depression.—In granting higher rates to the Illinois Bell Telephone Company the Public Service Commission of Indiana made the following interesting pronouncement on the right of a public utility to earn a fair rate of return in bad times as well as good: "Although the commission hesitates to increase rates at a time when business generally is depressed and prices show a tendency to decrease, it cannot deny an increase in rates to a utility which has not earned a reasonable return in recent years; which furnished service throughout the war period at less than cost, while unregulated private corporations were making large profits; whose reasonable requirements for an estimated year are $215,660 in excess of its estimated revenues under present rates, and which is efficiently and economically managed, since the utility must continue to give service, extend its lines and improve its equipment, and the only source of revenue and credit is from the subscribers and patrons who pay the rates. It is contended that in times of business depression a public utility should be required to forego its profits and take its losses like any private corporation. This might be all right if during hard times a public utility were permitted to close its doors and suspend operation until business conditions became promising. It might be still more logical if a utility were permitted during boom times to enjoy large earnings and pay out its profits in dividends. Regardless of the state of business generally, a utility must continue to operate at maximum speed. It must continue to give service, for its service has become one of the necessaries of life. It must constantly extend its lines and add to and improve its equipment in order to keep up with the growth of its community and the developments of the art. The public demands these things. Their cost is great and will probably never again be at the pre-war level. As time passes and improvements are developed the service demands become more complex and insistent. There is but one source of revenue and credit, and that is from the subscriber and patrons who pay the rates."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Harrison Williams, who has been a director of the North American Company since June, 1920, has been elected chairman of the board as well as of the executive committee. As chairman of the board he is acting president of the company.

Harley W. Brundige of the California State Railroad Commission has been elected its president, succeeding Frank R. Devlin, former president, who resigned on May 1. Mr. Brundige has been a member of the commission since January, 1919, when he was appointed for a term of six years. He was formerly an assistant to the publisher of the Los Angeles *Daily Express.*

Alex Dow, president of the Detroit Edison Company, has accepted an appointment to the board of directors of the Detroit United Railway, where he will bring his experience and administrative ability to bear in an effort to straighten out long-standing complications affecting the local street-railway service. Mr. Dow has long been recognized as a leader in the electric light and power industry. He has been president of the Detroit Edison Company since 1913.

Dr. A. E. Kennelly, professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology, will sail next Thursday, June 9, on the steamship France to take up his work as exchange professor in French universities. His selection for this important duty was announced in the ELECTRICAL WORLD for May 14, page 1125. Dr. Kennelly has obtained a year's leave of absence from Harvard and the Institute of Technology, which he will spend in France. He will attend the meetings of the International Electrotechnical Commission to be held in Paris this month.

Raymond D. Sherman has been appointed assistant electrical engineer for the Philadelphia Electric Company, with headquarters in Pittsburgh. Mr. Sherman is a graduate of Union University and completed a two years' apprentice course of testing and construction with the General Electric Company. He then secured a position with the Schenectady Power Company and worked up to be chief operator. This company is now the Adirondack Light & Power Company, Schaghticoke, N. Y. Later he was advanced to be electrical superintendent of that company, which position he left to become superintendent of the Deerfield River Power Company, Readsboro, Vt. One year later he was made superintendent of the Connecticut River Power Company at Vernon, Vt.

David Sarnoff, commercial manager of the Radio Corporation of America since its organization, has been appointed general manager. Mr. Sarnoff will supervise and control the operation of the corporation's plant and the conduct of its business subject to the direction and approval of the board of directors, the executive committee or the chairman of the board, through the president. In general he will have charge of the corporation's high-power, low-power and ship stations and their operation, as well as be responsible for their upkeep and the maintenance of

DAVID SARNOFF

their service. He will also be charged with the corporation's transoceanic communication system, the selling and rental of apparatus and the solicitation and negotiation of contracts. Mr. Sarnoff is now rounding out fifteen years of service with the Radio Corporation and its predecessor, the Marconi Wireless Telegraph Company of America, covering virtually every branch of the radio communication art.

F. B. Lewis was appointed assistant manager of operations for the Southern California Edison Company at the time of the reorganization recently, when the old organization of two operating divisions was abolished and the entire operation placed under the supervision of B. F. Pearson, manager of operations. Mr. Lewis was graduated from the Rose Polytechnic Institute at Terre Haute Ind., with the 1905 class of electrical engineering. Immediately thereafter he became employed by the Southern California Edison Company in the testing department. In 1906 he was promoted to the position of engineer of the underground department and later assumed the duties of illumination and power engineer in addition to his other duties. In 1912 he became superintendent of the Los Angeles district and had charge of all the city overhead and underground distribution and substations. Last year he was promoted to the position of power administrator and had charge of the system load operation and of the interconnections with other companies. In April, 1921, he was promoted to his present position.

James R. Lowe has been appointed general sales manager of the Harrisburg (Pa.) Foundry & Machine Works. Mr. Lowe was formerly sales engineer with the Midwest Engine Company, Anderson, Ind.

George W. Curtiss, sales manager of the Electric Railway & Manufacturers' Supply Company, recently left San Francisco for a seven weeks' business trip in the East. He acted as a delegate for the Pacific Division of the Electrical Supply Jobbers' Association at its annual convention at Hot Springs, Va., and attended the Westinghouse jobbers' convention at the same place.

James Dixon, who for the last year has been production manager of the Reliance Electric & Engineering Company of Cleveland, Ohio, has been appointed works manager. Mr. Dixon is a graduate of Columbia University and a member of the A. I. E. E. Prior to his association with the Reliance company he was connected with the Crocker-Wheeler Company as superintendent of construction, assistant chief engineer and works manager of the small-motor department. He has been a frequent contributor to the pages of the ELECTRICAL WORLD, chiefly along the lines of industrial applications. During the world war he was a junior lieutenant in the United States Naval Reserve.

Obituary

Edgar M. Graham, consulting engineer in Muskogee, Okla., since 1910, was killed May 14 in an automobile accident. For more than ten years Mr. Graham was chief engineer of the Muskogee (Okla.) Electric Traction Company. He built during this time about 10 miles of the Webbers Falls Railway Company. In 1900 he became assistant to Guthrie & Diehl, consulting engineers, Buffalo, N. Y. The following year he became connected with the New York Central Railroad and then was with the Lackawanna Steel Company for two years. In 1905 he became chief draftsman for the Buffalo & Susquehanna Railway Company and in 1907 was made assistant chief engineer. He entered private practice in Buffalo in 1908. Mr. Graham was forty years old and active in engineering society affairs. He was a member of the A. S. C. E. and president of the Muskogee chapter of the American Association of Engineers.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Report of Delinquent Accounts in N. E. C. A.

A GOOD idea of the general conditions of collections throughout the electrical industry is presented in the summary of Secretary Frederic P. Vose, National Electrical Credit Association, which met in annual convention at Richmond, Va., May 19 and 20. The total number of tardy and delinquent customers reported to the five associations was 192,088. Of the delinquent accounts reported, there was an average increase throughout the five associations of 67 per cent in number and 49 per cent to 242 per cent increase in the amount involved. The percentages reflect the general depression in the industry and the multiplying of unsatisfactory accounts.

Total of 202,000,000 Large Lamps Sold During Year 1920

TOTAL sales of lamps, excluding miniature, in the United States during the year 1920 amounted to 202,000,000 tungsten-filament lamps, according to the report of the lamp committee submitted before the National Electric Light Association in convetion at Chicago this week. This is an increase of 32,000,000 lamps, or 19 per cent over sales for the year 1919. In the ELECTRICAL WORLD of Jan. 1, 1921, it was estimated that 215,000,000 large tungsten lamps were produced in 1920.

In numbers the percentage of tungsten-filament lamps has shown a decided increase each year since their introduction until in the year 1920 they comprised 95.7 per cent of the total large lamps sold. On the other hand, the sale of carbon lamps has fallen off each year until in 1920 the percentage stood at 4.3 of the total sales. Their sales in 1920 amounted to 9,000,000 lamps, a decrease of 4,000,000 over 1919. Relative percentages of large-lamp sales from 1907 to 1920 are shown in the following table:

Year	Tungsten (Including Tantalum)	Carbon (Including "Gem")	Year	Tungsten (Including Tantalum)	Carbon (Including "Gem")
1907	0.8	99.2	1914	70.5	29.5
1908	7.3	92.7	1915	78.9	21.1
1909	15.9	84.1	1916	83.7	16.3
1910	22.0	78.0	1917	87.0	13.0
1911	28.1	71.9	1918	89.0	11.0
1912	41.0	59.0	1919	93.0	7.0
1913	56.7	43.3	1920	95.7	4.3

As stated in the committee's report for the previous year, there has been recorded each year an increase in the average candlepower of lamps sold. This increase is due in part to the utilization of gas-filled tungsten lamps in service formerly performed by other types of lamps. The figures for average candlepower, watts and efficiency for the past three years show a favorable increase which is interesting in indicating the upward trend in lamp manufacture and sales.

Each year the report has recorded the average candlepower, watts and efficiency of lamps sold. These figures for the past three years have been as follows:

	1918	1919	1920
Average candlepower (horizontal)	51.5	53.2	55.8
Average watts	52.7	51.5	53.3
Average lumens per watt	10.3	10.5	10.6
Average lumens	515	532	558

The tendency toward standardization of the different types and voltages of tungsten lamps is noticeable from the table that is given below. The gas-filled type is steadily increasing in sales, while the vacuum type is falling off. Still, of the 202,000,000 large lamps sold in 1920, 41,000,000 were of the gas-filled type and 161,000,000 of the vacuum type.

At the same time, while the gas-filled lamps comprised only 20.3 per cent in number, they aggregated 46 per cent in wattage and 56 per cent in candlepower. The 40-watt vacuum lamp still remains the most popular size, although the percentage has been decreasing steadily. The 50-watt size shows the greatest gain of all, the 1920 demand being 24,000,000 as compared with 16,500,000 in 1919. Lamps of the 100-watt vacuum type have fallen off in the last few years, while that size in the gas-filled type has steadily come up.

DISTRIBUTION OF TUNGSTEN FILAMENT LAMPS BY SIZES AND TYPES

	Per Cent of Total Tungsten Filament Lamps		
Size:	1918	1919	1920
Vacuum type:			
Sign lamps	4.9	4.3	5.8
15 watts	5.5	4.1	5.5
25 watts	22.4	21.0	18.8
40 watts	24.3	21.6	20.1
50 watts	8.4	9.7	11.9
60 watts	13.3	13.0	12.3
100 watts	2.0	1.3	1.0
Street railway	3.8	3.3	3.2
Others	1.7	2.7	1.1
Total vacuum type	86.3	81.0	79.7
Gas-Filled Type:			
50 watts	....	1.9	1.8
75 watts	4.1	5.5	5.9
100 watts	4.7	5.5	6.3
200 watts	1.9	2.2	2.3
300-1,000 watts	1.3	1.0	1.2
Street series	1.3	1.4	1.3
Others	0.4	1.5	1.5
Total gas-filled type	13.7	19.0	20.3

Gradual Resumption of Washing Machine Demand

DISCUSSION of prevailing business conditions by Secretary Seitz occupied the greater part of the opening session of the spring meeting of the American Washing Machine Manufacturers' Association, held May 18 and 19 at the Hotel Sherman, Chicago. A sudden revival of demand, he said, was not to be expected, but business in most lines was showing a fair increase for each month to date. He submitted the April report on production of washing machines, gathered through his office, as evidence of the gradual resumption of demand, showing that April production had increased over March. March, he added, had shown a large increase over preceding months.

At the afternoon session a committee was instructed to draw up a resolution opposing the passage of the Chicago ordinance which proposes to license all dealers in electrical applinces and to require tests of all electrical appliances sold in Chicago, and to co-operate with any other body fighting the bill.

Following this several examples of misleading advertising of washing machines were brought before the meeting, and it was decided that the matter was so vital to the welfare of the industry that it should be brought to the attention of the Associated Advertising Clubs at once and also that

members should use their influence with the publications concerned to have the practice discontinued. Members complained that advertising of washing machines at extremely low prices misled the public and the dealers to expect impossible cuts on legitimate products.

An educational program was proposed to acquaint dealers with the need of a proper spread between list and factory price, but no action was taken on it at that session.

Some Business Aspects in the Intermountain Region

LIGHT money is still the bane of business and industry in the Intermountain West, and loans are next to impossible to get even for the most urgent enterprises. Sheep men and cattle growers are reported in a quandary to know how to tide over the crisis. Warehouses are packed full of Western-grown fleeces, and some growers have as many as three seasons' clippings now on hand and can scarcely get money to meet current expenses. Most of them have reduced their employee force by upward of 50 per cent. Banks, it seems, come to the rescue only in extreme cases, and then often to protect their loans. At the same time the spring season, with its prolonged siege of cold and wet, has been unfavorable to lambing. The one hopeful sign of relief is the tariff bill that was just signed by the President, which excludes foreign wool.

Farmers are also hard put to it to finance the spring cultivation and planting. With beet growers seed is a big item of expense and sugar companies are giving relief here. They are also interceding for their growers with the banks in an effort to obtain for them loans to pay for the labor of cultivating and thinning. A late season has seriously retarded the sowing of crops. Despite the low market price on general farm products farmers are holding up to their acreage averages. Everything points to bounteous yields.

The copper industry is virtually nil as a market for electrical and other merchandise. The plants are only buying such supplies as are necessary to keep the physical equipment intact until operations are resumed.

Buying of Brushes by Central-Station Companies Close to Normal

MANUFACTURERS of carbon brushes quite uniformly report a quiet market for their product this spring. With industrial operation at its present low point in so many lines of activity throughout the country fewer motors are being run and fewer brushes are being bought. On the other hand, in certain lines, such as the steel industry, opportunity is being taken of slack production to overhaul electrical equipment, and there the demand for replacement brushes holds up fairly well. Electric railways are not endeavoring to carry surplus stocks, and their buying is of the hand-to-mouth order. Central-station companies at the present time are buying most nearly to their normal requirements.

There are signs of better business ahead, however; in fact, in certain quarters it is stated that the carbon-brush business this month represents an improvement over the previous three months. This is especially noted in the automobile branch of the industry, as brushes for starting and lighting sets had probably been hit hardest of all types when the automobile business slumped so severely. Producers as a rule are proceeding cautiously, nevertheless, on the supposition that the next few months may be lean ones. Production is down to 50 to 75 per cent of capacity and inventories have been reduced accordingly.

Stocks of the semi-finished products are in ample shape to take care of customers, however, for shipments at present are very prompt. Prices are still at their peak except with one producer who is selling brushes at their present replacement cost, and this, it is stated, figures about a 10 per cent reduction. Other manufacturers are quoting on a price basis which has remained constant since the latter part of 1918.

Interest in Trade Acceptances Continues to Grow

REPORTS coming in to the National Association of Credit Men show that certain companies consider the trade acceptance the most valuable of all collection instruments, especially in times like the present when there is a strong tendency on the part of retailers to let their obligations run and to use all sorts of excuses to delay payment. This form of payment is coming more and more into use, not only as a method of affecting collections but also as a sound type of commercial paper.

At the same time there has been found throughout certain sections of the country a reluctance on the part of banks to accept trade acceptances—particularly when these are in small denominations. One of the larger electrical supply jobbers has overcome this difficulty by taking trade acceptances on his monthly statement, thereby decreasing the number of his pieces of paper but considerably increasing the value of each one. Some banks that discounted this paper would have been unwilling to have discounted smaller amounts.

The number of acceptances is increasing in the electrical jobbing industry, although the denominations are smaller in amount. At the same time more jobbers are coming to realize that this two-name paper increases their turnover of capital, lessens their losses and makes for a better credit condition of both buyer and seller.

Many cutomers formerly on open account were frequently seen on the "past-due" list; but under the trade acceptance method of credit these names as a rule are missing from this list.

The Metal Market Situation

THE copper market shows a slight weakness in line with current weakness of demand. Domestic consumers remain out of the market, and foreign orders, which have been received in such encouraging volume of late, have fallen off. A decided break in foreign exchange rates last week was perhaps in part accountable for this, as it meant a corresponding lowering of the equivalent price per pound of spot copper at London. Copper for prompt and June shipment can be purchased at 13.25 cents per pound delivered, though the asking price of some producers ranges up to 13.50 cents. June and July copper is held at 13.50 cents, but it is thought this could be shaded. The full third quarter is quoted at 13.75 cents.

To stimulate the market, trading in standard copper was begun on the New York Metal Exchange on June 1 under a new and broad contract.

Demand for lead continues light, and with the drop in sterling exchange noted above foreign lead prices are approaching a figure where they will enter into competition. Zinc quotations are a trifle easier and the market as a whole is quiet. There is little pressure to sell tin, though prices are off slightly under the influence of lower London quotations and the break in the price of sterling; but on the other hand consumers are showing no more buying interest. The position of the scrap metals market is unchanged.

NEW YORK METAL MARKET PRICE

	May 24, 1921	May 31, 1921
Copper	£ s d	£ s d
London, standard spot	74 0 0	72 10 0
	Cents per Pound	Cents per Pound
Prime Lake	13.25	13.25
Electrolytic	13.12½—13.50	13.25–13.50
Casting	12.62½	12.50
Wire base	14.75—15.00	15.00—15.25
Lead, trust price	5.00	5.00
Antimony	5.25	5.25
Nickel, Ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	10.00	10.00
Zinc, spot	5.25	5.20
Tin	32.25	31.62½
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50—10.75	10.50—10.75
Brass, heavy	5.25— 5.50	5.25— 5.50
Brass, light	4.00— 4.25	4.00— 4.25
Lead, heavy	4.25— 4.40	4.25— 4.40
Zinc, old scrap	2.50— 2.75	2.50— 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

WHILE little of a hopeful nature is reported on business conditions in the electrical trade in the New York region and in the city of Chicago, other centers do show a little more life. Building permits in Boston increased well last week, the wiring supplies trade is quite good, and while prices are holding well for materials in small quantities, still on large lots there is some cutting. Trade outside of Chicago is increasing somewhat, and washing-machine makers have had a constantly increasing production this year. St. Louis industrials are inquiring for new property for expansion purposes, and the Standard Underground, it is reported, has purchased a large tract.

Residential construction is bettering in the Southeast and meters are moving well to municipalities and small central stations. Jobber business is getting better in number of orders and in size. Things are quiet in the Intermountain region because of poor stock sales and consequent credit restraints. The Northwest, too, is quiet, although broken somewhat by activity in residence building. Industrials are not expanding. New York contractors are doing quite a bit of estimating, but that is about as far as it goes for the present. Pipe and armored conductor prices are soft there. Fans are moving well in St. Louis and but little in New York.

NEW YORK

There does not seem to be any improvement in the electrical trade worthy of note in this section. Occasionally temporary spurts in business occur, and here and there jobbers report an upward tendency in sales, but the general situation is on a level with that which has prevailed for many weeks. From present indications little relief from the quiet market is promised before next fall.

Contractors are doing considerable estimating on building work, and there are plenty of plans in the air, but the results are still far in the future. With industrials generally operating at low capacity, that outlet for goods is now limited; shipyards are seeking longer credit terms and contractors are stocking nothing at all. On the other hand, this policy of non-stocking is providing an every-day source of bread-and-butter buying that helps to keep things going.

No new prices are reported this week, though conduit and armored-cable prices are soft with jobbers. Buying is from hand to mouth, and conservatism in stocking rules in all lines of goods, even in seasonable articles such as fans and flashlights, which have not started to move yet. Jobbers disagree on collections, but the situation with those whose collections have all along been good remains favorable, while with those whose collections have been tight no improvement is shown.

Lamp Cord.—In lots of 1,000 ft. No. 18 twisted cotton sells for $14 to $17.70 and No. 18 cotton parallel for $16.50 to $17.75. Demand is quiet and stocks are only fair except where jobbers act as agents, and there stocks are large.

Fans.—For the most part supplies have not started to move, there having been little good fan weather thus far. Stocks are good, but compared with other seasons the number carried is extremely conservative. The 16-in. oscillating fan, which jobbers are selling in lots of twelve for from $26 to $32.40, according to make, bids fair to maintain its popularity.

Flashlights.—The usual vacation run of sales in this line has not started, jobbers report, and renewal business is only fair. Stocks are spotty, and, in representative instances the discount allowed on standard packages is 40 and 10 per cent; in unit packages of ten, 40 per cent, and less than unit packages, 33⅓ per cent.

Conduit.—Stocks are spotty with not very much material moving. In 2,500-ft. lots prices quoted this week on ½-in. black range from $60 to $68 per 1,000 ft.; ½-in. galvanized, $65.70 to $73.40; 1-in. black, $116 to $127; and 1-in. galvanized, $125.60 to $137.90. The lower range is nearer the actual market, and even these prices are shaded.

Non-metallic Flexible Conduit.—In 1,000-ft. lots ⅜-in. brings from $22 to $24.75 and ½-in. from $23 to $27. Very little is being sold, though stocks are fair.

Knife Switches.—Demand is spotty, and so are stocks, though there is no scarcity of material. A standard single-throw, two-pole, 30-amp. fused switch jobbers sell for about 90 to 95 cents each in lots of a dozen.

Flexible Armored Conductor.—No. 14, two-wire, double-strip in 1,000-ft. lots is nominally selling for from $55 to $58 per 1,000 ft., but these prices are cut drastically under prevailing competition. Demand quiet; stocks fairly good.

Rubber-Covered Wire.—A few jobbers report a fair demand, but the general situation is weak. Some houses have large stocks, others are down to fair quantities. The market has settled to a price of $6.75 to $7 per 1,000 ft. for 10,000 ft. of No. 14 single-braid.

CHICAGO

Business from the country is better but is not of sufficient volume to bring the aggregate up to a fair volume. Local industrial conditions are disquieting. The construction labor controversy remains open and the shutdown is approaching the absolute.

Non-employment is on the increase in the Detroit district, with many large plants reducing forces and some of the big auto builders considering shutting down. In the steel plants along the south of Lake Michigan forces are being gradually reduced as the volume of "orders on book" continues to shrink. It is freely predicted that the present slump in the steel trade will persist until fall and that further cuts both in prices and in wages must come before any upward slant is found. In short, the general opinion is that, while the low point in trade may have already been touched, it will be some time before any better tendency is felt.

As regards collections no improvement is noted. Average collections with the large houses continue to range around ninety days. Contractors, fearful of a long-drawn-out controversy in the present labor troubles, are not stocking any materials and contractor-dealers are following the same procedure. Retailers find their stock moves slowly, as lack of employment is reducing the amount of money in circulation. No price changes of moment have occurred.

Line Material.—No price fluctuations in wire or other outside material have been noted. Demand is limited to out-of-town customers. Bare copper wire stands at 16½ cents per pound for No. 8 in 1,000-lb. lots and No. 6 weatherproof, triple-braided, is 17 cents per pound in similar quantities.

Inside Wiring Material.—Business is a little better in this line than any other as numerous rewire and repair jobs are under way. Prices are unchanged with rubber-covered No. 14 offered at $7 per 1,000 ft. in 1,000-ft. lots. Flexible armored conductor is finding slow sale at $57.50 per 1,000 ft. for the No. 14, two-wire.

Black Conduit.—The new quotation noted last week of $59 per 1,000 ft. in 5,000-lb. lots is not causing any appreciable increase in trade. Contractors and dealers alike are refusing to take any chance by stocking up.

Washing Machines.—Increased production is the story with washing machines. A steady recovery all through the year has occurred since last winter, and the industry as a whole is now making and selling more machines than at any time since last fall. Washers are recognized as a necessity and the liberal extended payment terms being offered are permitting a wide distribution. It is estimated that factories are now running on approximately 60 per cent capacity.

BOSTON

Trade is well sustained in wiring-supply lines, and while the demand for appliances fell off during the week-end holiday, considerable activity is apparent. House-wiring campaigns are proceeding well. Building and engineering contracts placed in New England during the week ended May 24 totaled $5,230,100, a gain of $1,433,500 over the preceding week. Labor troubles are still handicapping the resumption of normal building, however. In some engineering offices a better feeling is apparent and jobbers generally point to improved business in May against April of this year. Collections still have to be watched closely. Shortages in supplies are virtually unknown. Prices are holding firm in the main for small-quantity purchases, but on large sales, notably in wire, considerable cutting is apparently taking place. The New England Power Company has decided to go ahead with a 6,000-hp. development on the Deerfield River at Searsburg, Vt., hoping to complete a layout costing about $1,500,000 in 1922.

Meters.—Although the market is quiet, some orders hitherto held back from shipment are now being called for by the purchasers. Back orders are also keeping manufacturing facilities moderately busy.

Lamps.—Lamp sales hold up better than most other supplies. Stocks are excellent. Sign lighting is developing well.

Motors.—A quiet market continues, with some "pick-up" sales and a fair volume of scattered, small business. Nothing like the available productive facilities can be utilized in motor manufacture at present. Some distributors are moving their stocks slowly by offering less than factory prices. The market for second-hand motors is extremely quiet, owing to the supply of new motors available.

Wire.—A fair demand is reported. In 5,000-ft. lots No. 14 rubber-covered sells for $7 per 1,000 ft., and in 1,000-ft. lots at $10. Weatherproof wire sells as follows per 100 lb. in the triple-braid selection: Reels or large coils, solid No. 4/0 to No. 8, 100-lb. to 200-lb. lots, $21.50. No. 8 in 25-lb. coils, solid, in 100-lb to 200-lb. lots, sells for $22.50. Additions for stranding range from $0.005 per pound in No. 0 and larger to $0.04 per pound for No. 8.

Flexible Armored Conductor.—Sales are somewhat improved. One house is disposing of 10,000 ft. to 20,000 ft. per week—a subnormal volume, but encouraging nevertheless. No. 14 double-strip is moving at $60 per 1,000 ft. in 1,000-ft. lots, the market being open above this quantity. Plenty of this material can be had locally.

Plugs and Receptacles.—Some of these are moving into the contractors' hands following recent price concessions. A well-known line sells as follows: Plugs, less than cartons, 30 cents net; cartons, 27 cents net, standard packages, 24 cents net. Another number of plug, in lots of 1,000, sells at 15 cents net.

Lamp Guards.—Prices quoted on a leading make range from 50 per cent off double list on less than one-fifth of a standard package to 70 per cent off double list on five standard packages. Trade is moderate with good stocks as related to present demand.

Industrial Electric Trucks.—While the market is dull considerable interest is apparent in marine circles, and some competitive try-outs are reported under way along the Boston waterfront.

Electric Ranges.—Demand is quiet, with sales spotty. A leading manufacturer announced a price reduction approximating 7½ per cent effective June 1, owing to decreased factory costs. Deliveries are being made from stock.

ATLANTA

It is encouraging to note a slight improvement in business in general. Electrical jobbers report that their business for the past two weeks shows considerable increase over prior periods as regards not only the number of orders being received but also the volume of the individual orders, which is increasing. The increase in the number of inquiries is evidence of a decision on the part of the industrial plants to take up improvements and expansions which were allowed to be dropped in the early fall. The textile mills seem to be entering upon a more active market. Three of the largest mills in Georgia, which have been shut down for some time, were permanently reopened last week. Private concerns estimate the 1921 cotton crop at 8,000,000 bales, the smallest yield in many years. This should lend a firmer tone to the cotton market despite the carry-over of last year's crop of 13,000,000 bales. It should also go far to stimulate activities in the rural districts. Construction, particularly of the small residence and the commercial house, is getting well under way, as is evidenced by building permits in the eight principal Southern cities for April which totaled $2,960,000. This movement should be further stimulated by the reduction in building cost, a bulletin of the Association of Contractors and Builders showing that construction is costing approximately 70 per cent what it cost a year ago.

Fans.—Despite the recent warm spell, the movement in this line is not up to jobbers' expectations, though they still hold a most optimistic outlook for the season.

Rigid Conduit.—The market continues quite dull, and nearly all jobbers have accumulated heavy holdings. There is little movement of the larger sizes, though ½-in. and ¾-in. sizes of black are moving quite well in the large centers.

Flexible Armored Conductor.—This continues quite active, especially on the smaller jobs. The price is steady at $70 per 1,000 ft. for No. 14, two-wire, single-strip.

Industrial Lighting Fixtures.—Advertising campaigns are serving to hold up sales in this line, the 100-watt and 150-watt sizes being reported as the most popular. Local stocks are in good shape with shipments at two weeks. A price advance amounting to approximately 20 per cent was announced May 15.

Pole-Line Material.—Cross-arm braces and through bolts are reported quite active, while other lines of hardware are dull. Cross-arms, pins, insulators and poles are all reported slow, purchases being for current demand only. Stocks of all items are plentiful with no recent change in price noted.

Meters.—The purchase of meters by municipalities and small central stations continues to hold up well, the 5-amp. and 10-amp., two-wire type leading in volume. Stocks are in good condition.

Schedule Material.—This line continues slow with purchases still on the hand-to-mouth basis. Stocks of the entire line are in good condition, except for a shortage here and there in certain types of switch plates and cut-outs. Snap switches and key sockets are reported the most active, with rosettes the slowest.

Lamps.—The sale of the larger size lamps is keeping pace with the activity in the industrial lighting fixtures. Orders for 75-watt, type C, lamps are above the average.

ST. LOUIS

The best news from the industrials this week was the announcement on the part of the Standard Underground Cable Company of Pittsburgh of its purchase of a 12-acre tract upon which a wire factory will be built in the near future. Other concerns are making inquiries for real estate and the indications are for a good volume of industrial construction work, though it is problematical as to when it will begin. Wages have not been reduced at all in the building lines, and until some concession is made a vast amount of work will be held off the market.

Unseasonably warm weather has added impetus to fan sales, both retail and wholesale. No appreciable increase in sales of other summer appliances has as yet resulted. In fact, except for the increase in fan sales, business on the part of electrical jobbers shows almost no change.

Stocks are in general in good shape though some jobbers report an oversupply of schedule material. The demand for electrical materials is apparently composed of a large number of small orders, representing a healthy condition. As stocks in hands of contractors and retailers are being maintained at a minimum, it is believed that business for the jobbers will show improvement just as rapidly as business confidence is restored.

Knobs and Tubes.—A cut in the price of "Nail-it" knobs is announced, the new price being about $19 per 1,000, with

the maximum at $20.80. Local stocks are not considered too heavy, and yet the demand is quite low. The price on tubes is unchanged.

Fans.—Heavy buying by consumer and retailer was found last week as a result of the unseasonablly warm weather. Jobbers report that the largest call is for ceiling fans because they are not stocked by the retailers. They expect the demand for the popular styles to be heavier in a month or so as the stocks in the hands of retailers become exhausted. Stocks in hands of jobbers are considered to be on a conservative basis.

Flatirons.—Only a slight improvement in demand is reported except in the case of one or two lines on which special campaigns are being conducted. Local stocks are on a reasonable basis.

Poles and Cross-Arms.—The expected large business in these items has so far failed to develop. One reason advanced is that the inquiries which were received in such attractive amounts were based on transmission extensions for industrial business which is slow to materialize. One large jobber reports an actual decrease in business for the week. Stocks are in fairly good shape.

Wire.—Demand and supply remain unchanged, and though the prices are as low as they are expected to go, no one shows any appreciable tendency to stock. No. 14 rubber-covered, in 5,000-ft. lots, is selling at about $6.75. In 100,000-ft. lots sales are being made at $6.35 to $6.50, the variation being largely due to the quality of the wire. The base price quoted on bare and weatherproof varies from 15 cents to 16 cents.

Schedule Materials.—The demand is found to be very quiet with stocks somewhat heavy. There is a tendency to cut prices on the part of those jobbers with heavy stocks, and there is an underlying feeling that a general price reduction is about due.

SAN FRANCISCO

The outstanding event of the past week was the spread of the building trades strike to the electrical contracting industry, with the result that not only are all the San Francisco and Oakland contractors shut down but that other localities also have become affected, with a prospect of the strike becoming state-wide. So tight is the situation that practically no shipments are being made by jobbers to the affected area because no orders are being received, and all city salesmen of San Francisco and Oakland jobbers have been asked to take their vacations the first two weeks of June.

Household Material.—Naturally the labor situation has not improved the morale of the buying public, and very desultory sales of appliances are reported. There are virtually no sales crews working for dealers, and those dealers who specialize on appliances are finding the services of the crew captain to be sufficient. However, should the strike last it is probable that there will be increased appliance efforts made by dealers to offset their contracting loss.

Conduit.—Prices have recently been amended to eliminate the less-than-500-lb. quantity which was formerly 20 per cent higher in price than the 500-lb. to 10,000-lb. quantity. The 10,000-lb. assorted is now the minimum quantity for all finishes.

Conduit Fittings.—Condulets have dropped in price from 20 to 25 per cent. Like all roughing-in lines, they are now very slow save in the southern part of the state.

Wire.—Although the more sanguine expected that rubber-covered had finally touched bottom, a new low mark of $7.20 per 1,000 ft. for 5,000-ft. lots of No. 14 single-braid solid is recorded. Weatherproof wire has just taken a drop of 50 cents per 100 lb., making a new base of 19 cents per pound for triple-braid base sizes.

Lamps.—Jobbers are circularizing the trade regarding their requirements for Christmas tree outfits. From present indications there will be little change over last year's styles and prices. A determined effort is being made to reduce the value of consigned lamps on the dealers' shelves, it being found that in many cases their value totals more than the value of the same stocks at the first of the year.

SALT LAKE CITY—DENVER

It is the feeling of contractors that there will be a substantial building boom once the prices of materials come down to a point that will make it practicable, and many large projects are awaiting this. This period of relative inactivity is conducive to a general accumulation of stocks in the warehouses of jobbers and on the shelves of dealers.

Vacuum Cleaners.—The movement is satisfactory. Dealers report a good demand, especially since the advent of housecleaning time. With one or two exceptions there has been no trouble in getting quick shipments from the factories and in unlimited quantities.

Motors.—A field of almost unlimited possibility is afforded by the growing use of motors to provide flow for private irrigation systems. Farmers and fruit growers are coming to use them extensively to supplement the water that reaches them by gravity flow. Central stations are leading the way in this development, and dealers in motors are competing vigorously for installation contracts.

Farm Lighting and Power Plants.—Sales at present are few. Farmers are hesitant about investments at a season when crop yields are uncertain. Jobbers, however, are perceiving the possibility ahead and sparing no effort in the work of educating the farmer to the need of electric service on the farm.

SEATTLE—PORTLAND

Conditions in the electrical business in the Northwest generally and the Puget Sound district specifically show but little change from week to week. Buying is of the hand-to-mouth variety, and from present indications this condition will probably obtain until well into the summer and possibly later. The buying which will materialize from logging camps, lumber mills, fish and fruit canneries and other industrials has not, and undoubtedly will not, approach the volume expected, neither will sales of domestic appliances, movement of which is very light. At present washing machines, ranges and cacuum cleaners are showing a fair movement, but sales are away below the mark set for this season of the year. The movement of percolators, chafing dishes, flatirons, etc., is expected to register satisfactory increases during June, but jobbers and dealers are well prepared to handle normal demands.

Schedule material, owing to the constantly increasing building program, of both residence and business structures, is moving in a fair way, and the demand for this merchandise is expected to continue showing improvement until late in the fall. Improvement in building is noted throughout the entire Northwest, and Seattle, Tacoma, Everett and Bellingham report favorable indications of a continuance of this condition. Prices are fluctuating downward, but the decrease is gradual. Certain lines, it is believed, are near rock bottom, while others will continue dropping until fall. The last observation applies particularly to domestic appliances. Manufacturers in the Portland district report no material change in general business or collections, but jobbers state that collections are slightly better. Improved collections, however, are partly due to greater activity of collection departments.

Considerable activity is reported in the construction of new transmission lines in various counties throughout Oregon. Contractors generally report quiet business so far as large contracts are concerned, but small contracting work continues about the same, there being an increasing amount of residence work. The marine strike continues and will undoubtedly result in the closing down of a number of lumber mills and other industries because of lack of an outlet. In the Portland district it is freely predicted that there will be very little change in business in general before the fall movement of crops, which will provide a new supply of money and relieve the situation resulting from lack of movement of last year's crops.

Flashlamps.—With the coming of the camping season dealers report an increasing demand. Stocks are ample and prices are steady.

Meters.—Northwest jobbers in considerable numbers report an increasing demand occasioned by increased residential construction and some transmission extensions.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Standard Underground Cable to Erect St. Louis Factory

Announcement is made on the part of the Standard Underground Cable Company of its purchase of a 12-acre tract in St. Louis on which in the near future a large plant is to be erected for the manufacture of cable and other forms of insulated wire, supplementing its four other factories. A million-dollar addition is now being made to its plant in Pittsburgh.

Lighting Fixture Manufacturers to Meet in July

The midsummer meeting of the National Council Lighting Fixture Manufacturers will be held at West Baden, Ind., July 6, 7 and 8. Capacity attendance is requested by the secretary as matters of importance to the lighting-fixture industry will be discussed.

Armstrong Radio Patent Upheld for Westinghouse

As a result of litigation extending over a period of years, the Armstrong radio "feedback" patent, controlled by the Westinghouse Electric & Manufacturing Company, has been held valid by Judge Mayer in the United States District Court, Southern District of New York. The De Forest Radio Telephone & Telegraph Company was the defendant which, it was ruled, infringed all the claims presented. The employment of the "feedback" arrangement, it is held, greatly increases both the loudness and the definition of sounds heard in the receiver, improving long-distance radio communication.

Educational Program by Washing Machine Manufacturers

The report of Miss Mary E. Keown, head of the educational bureau of the American Washing Machine Manufacturers' Association, was presented before the spring meeting of that organization, held in Chicago, May 18-19, and showed that the efforts of the association to educate the public in the proper use of the washing machine were bearing fruit. Accordingly the work of the bureau will be continued more extensively, it was announced.

Several months ago bulletins were printed on the subject of "Laundering at home." Although it was not attempted to give extremely widespread publicity to this fact, there were calls for 59,000 bulletins in five weeks. Each request averaged twenty-five copies so that the calls came from about 2,200 sources. Arrangements have been completed for lectures to be given by Miss Keown on the subject of "Laundering at Home" before the Southern Home Economics Bureau and the National Bureau of Home Economics.

N. E. C. A. to Consider Sales Terms and Cash Discounts

Resolutions were presented at the convention of the National Electrical Credit Association, held at Richmond, Va., May 19 and 20, according to the summary of Secretary Vose, declaring it to be the sense of those present that the variety of sales terms and numerous cash discounts prevailing were distinctly detrimental to the electrical industry and uneconomical to manufacturers and jobbers alike. It was proposed that a committee be formed, composed of representatives from the Electrical Supply Jobbers' Association and Associated Manufacturers of Electrical Supplies, to act in conjunction with the N. E. C. A. and to give consideration to standardizing sales terms and cash discounts.

Arrow Electric Company Upheld in Trade-Mark Suit

Judge Killits recently handed down an opinion in the federal court in Ohio establishing the exclusive right of the Arrow Electric Company to the trade marks "Arrow" and the symbol of an arrow for electrical wiring devices and the like, and in addition holding that the use of the name "Arrow Manufacturing Company" in a similar line of business was on the facts proved a case of unfair competition. The action was to restrain the use by defendant (now, by changed corporate name, Airway Electric Appliance Corporation) of the figure of an arrow on its goods and the use of the word "Arrow" to designate its manufactures.

Manhattan Electrical's Business Shown in 1920 Report

For the year ended Dec. 31, 1920, the Manhattan Electrical Supply Company, 17 Park Place, New York City, reports net profits after expenses and taxes of $153,041, as compared with $702,910 for the preceding year. Net sales in 1920 amounted to $7,286,446, an increase over the preceding year of more than $300,000, but the cost of sales in 1920 was $5,608,475, or $550,000 more than in 1919. Expenses and taxes in 1920 increased so much that the resulting net was comparatively low.

Accounts receivable amounted to $754,249, a decrease of about $160,000 from this item for 1919. Inventories have been rated at $2,767,375.

Machen Company Reports Larger Demand for Specialties

The Machen Electric Manufacturing Company, Bridesburg, Philadelphia, manufacturer of push-button switches, receptacles and ground clamps, states that, although it is a new company and has only been shipping its products since last December, its sales have steadily increased. The company is bringing out a Duplex receptacle similar to the standard receptacle, which will be ready for delivery by July 1. The company is represented by Hermans-Griffith Company, San Francisco; A. W. Marshall Company, Detroit; W. A. Hendrickson, Boston; George H. Maire, Seattle; Metropolitan Distributing Company, New York City; Sperry & Bittner, Pittsburgh; E. F. Reinhardt & Company, St. Louis; E. M. Scribner, Chicago; Southern Jobbers' Supply, New Orleans, and Samuel Toole, Indianapolis.

New Store and Warehouse for Electrical Supply Company

The N. Hirschfeld Electrical Supply Company, formerly at 147 Bowery, New York City, announces that it has removed its main store and warehouse to 78 Warren Street, where it has much better facilities and will carry much larger stock. This location was chosen because of greater convenience for transportation and for traveling in and around the city. With an increased selling force and service department the company plans to improve its service to the trade both in and out of the city.

Edison Industrial Lighting Exhibit Returns Home

Completing a tour of approximately seventy cities in twenty states since the first of the year, during which the idea of better industrial and commercial lighting has been demonstrated to between 10,000 and 11,000 factory executives, business men, architects and others, the industrial lighting exhibit sent out by the Edison Lamp Works of the General Electric Company has finished its schedule. Plans are now under way for sending it out again next fall and for introducing new features in connection with it.

Approximately the same percentage of attendance was recorded throughout as that noted in these columns on March 19, when returns were sent in after the first third of the trip.

While the exhibit was designed to promote the idea of industrial lighting on a scientific basis, it had none the less a direct and immediate effect in increasing sales.

The Armature Coil Equipment Company, Cleveland, has awarded contract for the erection of a factory to cost about $40,000.

The C. H. Wheeler Manufacturing Company, Lehigh and Sedgley Avenues, Philadelphia, manufacturer of condensers, pumps, etc., announces that it has established a new branch office in Boston at 53 State Street.

The American Engineering Company, Philadelphia, has appointed Isaac Hardeman as sales agent to represent the Taylor stoker in North Carolina, South Carolina and Georgia. His office is 816 Realty Bulding, Charlotte.

The Ohio Ice Machine Company, 1579 Columbus Road, Cleveland, manufacturer of ice-making machinery, has awarded contract for construction of a new one-story and two-story plant, 50 ft. x 100 ft., to cost about $25,000.

The Rome Wire Company, Rome, N. Y., and Buffalo, N. Y., has opened district sales offices at 50 Church Street, New York City. H. S. Hammond, who has represented the company in the Eastern territory during the past twenty years, will be in charge.

Pass & Seymour, Inc., Syracuse, N. Y., announces the appointment of L. L. Parkinson as Chicago district sales manager to succeed William Hall, Jr.

The General Electric Company, Schenectady, N. Y., has been authorized to increase its capital stock from $175,000,000 to $185,000,000 as the spread between authorized and issued stock, it was felt, had become too small.

The Champion Engineering Company, Kenton, Ohio, manufacturer of Champion electric cranes, has established an engineering, service and sales headquarters at 326-327 Ferris Building, Columbus, Ohio. R. W. Valls, vice-president of the company, is in charge of the Columbus office.

The Luthy Company, Inc., Oakland, Cal., recently organized, has acquired a factory at Hayward, Cal., which it will equip for the manufacture of storage batteries. The plans provide for an initial output of 400 batteries per day. J. P. Schiller, manager of the Luthy Battery Company, San Francisco, a branch of the parent organization, is in charge.

Foreign Trade Notes

GERMAN WIRE-ROLLING MANUFACTURERS TO DISSOLVE.—At a session of the German wire-rolling-mill manufacturers it has been decided to dissolve the wire syndicate on July 1. This decision is due to the fact that some of the largest manufacturers had already withdrawn from the association.

ELECTRICAL APPLIANCES DUTY FREE IN LETTLAND.—On April 21, the Lettland government passed a law according to which machinery, tools and electrical appliances will be admitted duty-free into the country. Several large electric plants are at present under construction and several railroad lines are soon to be electrified.

AUSTRIAN DISTRICT TO ELECTRIFY.—The little Alpine country of Vorarlberg in Austria will soon build a powerful electric station and a transmission system to be extended all over the country. The first sum of 50,000,000 crowns has already been appropriated for this purpose, and work is to be started in the near future. The whole enterprise will be operated by the state.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An inquiry has been received from Spain (No. 34,922) for machinery for modern slaughtering and meat-preparing establishments, equipped with all the latest machinery, such as chopping machines with electric motors adapted to 110 volts.

An engineer in France (No. 34,925) who proposes to equip a large number of plants for the preparation of materials for the reconstruction of the devastated regions of that country desires to be placed in touch with American firms which can supply pneumatic or electrically operated machinery for tamping cement, etc.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT FOR JAMAICA.—Plans are under consideration for the construction of a hydro-electric plant in Jamaica, to cost about £614,740. The present plans provide for a 6,000-kw. development, to include the erection of three power stations equipped with a water turbine directly connected to a three-phase alternating-current generator. Transmission will be both by underground cable in one section and by overhead lines to a main line along the railway. The project also includes the electrification of the railways on the island.

COMMERCE REPORTS NEW TELEPHONE SYSTEM IN ASUNCION, PARAGUAY.—As soon as the commission of engineers chosen by the President of the Republic of Paraguay decides upon the system of telephones to be used in Asuncion, the President will call for bids for installation of same in accordance with Law No. 454, approved Dec. 18, 1920.

New Apparatus and Publications

OIL CIRCUIT BREAKER.—The Condit Electrical Manufacturing Company, South Boston 27, Mass., has placed on the market its type D-17 oil circuit breaker with resiliently suspended tanks in single units up to 1,200 amp. at 15,000 volts and up to 800 amp. at 25,000 volts.

MOTORS.—The Electric Specialty Company, Stamford, Conn., has issued bulletin No. 234, covering its "Esco" polishing, buffing and grinding motors.

THERMOMETERS.—Bulletin No. 16 published by the Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J., describes its "Ideal" pyrometric outfit for temperature measurement work with thermocouples.

SYNCHRONOUS MOTOR CONTROL.—The General Electric Company, Schenectady, has issued bulletin No. 48,032, entitled "Synchronous Motor Control Apparatus and Exciters," supplementing bulletin No. 41,309.

DRY BATTERY.—The Manhattan Electrical Supply Company, Inc., 17 Park Place, New York City, has added another unit to its "Red Seal" dry battery line. This new device is known as the "Red Seal" utility battery.

STEAM PUMPS.—The National Transit, Pump & Machine Company, Oil City, Pa., is distributing bulletins Nos. 102-A and 105-A, covering its Transit duplex piston steam pumps, Klein type, and its Transit duplex direct acting, slush and valve pot type steam pumps respectively. The company has also issued bulletin No. 5-C describing its tools for pipe line construction.

PIPING.—"Power Plant Piping" is the title of a 130-page catalog giving tables and illustrations, distributed by the M. W. Kellogg Company, 90 West Street, New York City.

FLEXIBLE COUPLING.—The Kay Manufacturing Company, South Norwalk, Conn., is distributing a folder covering its new free-floating shaft coupling.

BELL-RINGING TRANSFORMER.—The Amrevo Electric Company, 2309 Archer Avenue, Chicago, has put on the market a direct-current bell-ringing transformer under the trade name "Signalrite Type B," which is designed to furnish alternating current at 10 volts and 20 volts on 110-volt and 220-volt circuits.

EXCAVATOR.—Pamphlet SX, recently published by the Pawling & Harnischfeger Company, Milwaukee, describes the new P. & H. shovel attachment for use with standard P. & H. types 205 and 206 excavator cranes.

BRONZE PRODUCTS.—The American Brass Company, Waterbury, Conn., is distributing a sixty-four-page booklet covering its copper products, etc., including price lists.

TOBIN BRONZE.—The American Brass Company, Ansonia Branch, Ansonia, Conn., has issued a fifty-eight-page booklet describing its "Tobin bronze" and its uses, etc., with price lists.

WIRE.—The Copper Clad Steel Company, Braddock P. O., Rankin, Pa., is distributing a leaflet showing loading tables and characteristics of its Aristos "Copperweld" wire.

New Companies

THE ELECTROL MANUFACTURING COMPANY, New York, N. Y., has been incorporated by A. L. Wyman, J. Behrens and W. O. Bacon. The company is capitalized at $200,000 and proposes to manufacture electrical and mechanical specialties. C. A. Levy, 34 Nassau Street, heads the company.

THE HOWLAND BATTERY COMPANY, Detroit, Mich., has been incorporated with a capital stock of $25,000 to manufacture electric storage batteries and battery accessories. The incorporators are George A. Howland, James Romas and Joseph I. Cox, 6536 Sixteenth Street, Detroit.

THE PITTSBURGH FIRE ALARM COMPANY, Pittsburgh, Pa., has been incorporated with a capital stock of $50,000 to manufacture electric alarms and other electrical equipment. J. H. Forrest, 1421 Bristol Street, is treasurer.

HARTT & LANE, INC., New York, N. Y., has been incorporated with a capital stock of $52,500 to manufacture electrical appliances. The incorporators are N. Lane, Jr., J. J. Hartt and F. H. Field, 29 Liberty Street.

THE ANCHOR BRONZE COMPANY, New York, N. Y., has been incorporated by R. J. Kupferrman, M. Lovitch and J. Schaefer, 1703 Washington Avenue. The company is capitalized at $10,000 and proposes to manufacture electric fixtures.

THE LIBERTY LAMP WORKS, 111 Grand Avenue, Harrison, N. J., have filed notice of organization to manufacture electric lamps. M. H. Rosenberg, 231 First Street, West Newark, N. J., is interested in the company.

THE MULTIPLE STORAGE BATTERY COMPANY, New York, N. Y., has been incorporated wth a capital stock of $1,000,000 to manufacture batteries and other electrical specialties. The company is represented by Arthur W. Britton, 65 Cedar Street.

THE PINE CREEK ELECTRIC LIGHT COMPANY, Lock Haven, Pa., has been incorporated with a capital stock of $5,000 to install and operate an electric light and power system in this section. W. S. Harris is treasurer.

THE DEAL ELECTRIC COMPANY, New York City, has been incorporated with a capital stock of $25,000 to manufacture electrical products. The incorporators are J. H. Tuttle, R. Eckstein and B. Mintz. The company is represented by Barnett & Mintz, 44 Court Street, Brooklyn, N. Y.

THE NORTH AMERICAN ILLUMINATING & ENGINEERING COMPANY, New York City, has been incorporated by A. N. Bernard, S. Stein and M. Berstein, 167 East Broadway. The company is capitalized at $5,000 and proposes to manufacture electric lamps, etc.

THE JERSEY STATE ELECTRIC COMPANY, Elizabeth, N. J., has been incorporated by Joseph M. Waldo, 1182 Elizabeth Avenue; Samuel Gelber and Louis Solins. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical products.

(Issued May 3, 1921)

1,376,604. PROCESS OF PRODUCING PHOTO-ELECTRIC CELLS; Theodore W. Case, Scipio, N. Y. App. filed Aug. 27, 1920. Permanent in activity.

1,376,605. PHOTO-ELECTRIC CELL; Theodore W. Case, Scipio, N. Y. App. filed Aug. 27, 1920. Constant and uniform in reaction.

1,376,606. PHOTO-ELECTRIC CELL; Theodore W. Case, Scipio, N. Y. App. filed Aug. 27, 1920. Permanent in activity.

1,376,610. METHOD OF EXTRACTING BROMINE AND APPARATUS FOR USE THEREIN; Herbert H. Dow, Midland, Mich. App. filed June 7, 1916. From natural brine.

1,376,618. NON-METALLIC FLEXIBLE CONDUIT; Hans Hansen, Maspeth, N. Y. App. filed July 1, 1919. Circular loom.

1,376,627. TERMINAL CONNECTION; Homer W. Jones, Lakewood, Ohio. App. filed Oct. 10, 1919. For carbon electrode of dry cells.

1,376,633. RELAY; John A. Obermaier, Chicago, Ill. App. filed April 5, 1920. Secondary action controlled by varying primary action.

1,376,657. RESISTANCE WELDING MACHINE; Sigurd Thronsen, Chicago, Ill. App. filed Oct. 30, 1919. Work fed along under reciprocating electrode.

1,376,679. RADIO RECEIVING SYSTEM; Austen M. Curtis, Brooklyn, N. Y. App. filed Oct. 10, 1917. Reduction of static interference.

1,376,688. TROLLEY HARP AND TROLLEY HEAD THEREFOR; Charles T. Gillenwater and John L. Pedigo, Bluffield, W. Va. App. filed April 7, 1920. For maintaining wheel in accurate alignment.

1,376,712. WALL SOCKET; Ernest G. Liebold, Detroit, Mich. App. filed Oct. 11, 1918. Hospital call system.

1,376,713. PROCESS FOR PRODUCING MOTOR FUEL; John R. McCabe, Wichita, Kan. App. filed Oct. 27, 1919. Hydrocarbon oils and gases treated to produce liquid.

1,376,719. WHISPER PHONE; William Molloy, Chicago, Ill. App. filed March 18, 1920. Attachment for telephone.

1,376,722. TROLLEY-WHEEL GUARD; John A. Murray and Robert S. Buchanan, Patton, Pa. App. filed Nov. 9, 1918. For preventing jumping.

1,376,729. HIGH-SPEED REVOLVING FIELD MAGNET; Reinhold Rudenberg, Charlottenburg, near Berlin, Germany. App. filed Sept. 30, 1915. Slot construction.

1,376,735. CONTACT PIN FOR CONNECTING PLUGS AND PROCESS FOR THE MANUFACTURE THEREOF; Otto Stalhane and Olof O. Kring, Djursholm, Sweden. App. filed July 8, 1919.

1,376,758. OPERATING MECHANISM FOR ELECTRIC FURNACES; James H. Gray, New York, N. Y. App. filed April 12, 1919. Electrodes held in fixed position with reference to tilting furnace.

1,376,814. MEASURED-SERVICE TELEPHONE SYSTEM; Emil Jacobsen, New York, N. Y. App. filed Feb. 12, 1919. Few mechanisms for several phones.

1,376,829. ELECTRIC STOVE; Sebring I. Phelps, Wilmette, Ill. App. filed May 10, 1919. Heating elements movable.

1,376,841. LIGHT REGULATOR; Allen A. Tirrill, Pittsburgh, Pa. App. filed May 14, 1919. For vehicle lights.

1,376,842. ELECTRIC WARMER; John W. Tufts, Milwaukee, Wis. App. filed Oct. 20, 1919. Heating pad.

1,376,848. AUTOMATIC TELEPHONE SYSTEM; Bernard D. Willis, Oak Park, Ill. App. filed March 29, 1920. To eliminate click.

1,376,890. CHRONOGRAPH; Alfred L. Loomis, U. S. A. App. filed Nov. 7, 1919. For measuring speed of projectile.

1,376,893. TELEPHONE SWITCHING APPARATUS; James L. McQuarrie, Montclair, N. J. App. filed May 13, 1918. Automatic.

1,376,905. SEAL FOR BATTERIES; Norman D. Sturges, Bellerose, N. Y. App. filed April 24, 1918. Seal between cover and terminal post.

1,376,920. PLATE FOR STORAGE BATTERIES AND METHOD OF MAKING SAME; Rufus N. Chamberlain, Chicago, Ill. App. filed Aug. 11, 1919. Planté type.

1,376,923. NON-SPILLABLE BATTERY JAR OR CONTAINER; Herbert Dean, Clifton Junction, near Manchester, England. App. filed Oct. 24, 1918. To ventilate battery and prevent spilling.

1,376,927. RETAINER OR SEPARATOR FOR SECONDARY OR STORAGE BATTERIES; Bruce Ford, Philadelphia, Pa. App. filed Feb. 8, 1918. Slit wall having a permanent open set imparted to slits.

Record of Electrical Patents

Notes on United States Patents

1,376,928. SECONDARY OR STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed April 12, 1916. Flexible intercell connections of few parts.

1,376,929. STORAGE-BATTERY PLATE; Bruce Ford, Philadelphia, Pa. App. filed Jan. 23, 1920. Large portion of frame embedded in active material.

1,376,932. STORAGE BATTERY; Charles D. Galloway, Philadelphia, Pa. App. filed Dec. 5, 1919. Seal between jar cover and post.

1,376,963. PROCESS OF UNITING ALLOY STEEL TO CARBON STEEL; Oscar L. Mills, Easton, Pa. App. filed Oct. 10, 1919. Electrode coating.

1,376,971. VACUUM-CLEANER ATTACHMENT; George Qualman, Toledo, Ohio. App. filed March 11, 1920. Hair drier.

1,376,976. FLASHLIGHT DEVICE; Paul C. Smalley, Newark, N. J. App. filed Jan. 13, 1920. Battery will not break lamp when dropped.

1,376,978. REGULATOR FOR ALTERNATING CURRENTS; Erwin R. Stoekle, Milwaukee, Wis. App. filed Nov. 24, 1917. Electromagnetic.

1,376,987. PROCESS OF MAKING ELECTRIC HEATERS; Charles Wirt, Philadelphia, Pa. App. filed Dec. 2, 1918. Flexible pad.

1,377,000. SYNCHRONIZING CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed May 13, 1920.

1,377,021. PROCESS OF CLARIFYING AND DECOLORIZING OILS; Russel W. Mumford, New York, N. Y. App. filed July 11, 1917. Bleaching fatty oils.

1,377,059. PRODUCTION OF ELECTRICAL CURRENT PULSES; Fulton Cutting, Tuxedo Park, N. Y. App. filed June 26, 1918. Radio.

1,377,060. RECHARGEABLE ELECTRIC BATTERY; Henry R. Dam, Brooklyn, N. Y. App. filed Dec. 12, 1918. Dry type.

1,377,061. ELECTRIC DOOR LOCK; Gustav Deeg, Newark, N. J. App. filed Feb. 27, 1920.

1,377,074. SELF-REGULATING DYNAMO-ELECTRIC MACHINE; William Holt, Birmingham, England. App. filed Jan. 5, 1920. For automobiles or railways.

1,377,092. COOKER OR LUNCH BOX; Toussaint Phaneuf, Newport News, Va. App. filed May 6, 1919. For cooking or keeping food warm.

1,377,126. BATTERY TERMINAL; Albert H. Haefele, Lakewood, Ohio. App. filed Jan. 23, 1914. Spring clip.

1,377,127. ELECTRODE TERMINAL; Albert H. Haeffele, Lakewood, Ohio. App. filed Jan. 23, 1914. For carbon electrodes of dry cells.

1,377,128. ELECTRODE TERMINAL; Albert H. Haefele, Lakewood, Ohio. App. filed Jan. 23, 1914. Spring clip for dry-cell carbon.

1,377,129. UNDERWATER WAVE TELEGRAPHY; Walter Hahnemann, Kiel, Germany. App. filed Jan. 2, 1915. Radio under water.

1,377,144. TRANSMITTER; Francis C. Breckenbridge, Providence, R. I. App. filed Dec. 6, 1919. Telephone.

1,377,148. STORAGE BATTERY; Samuel R. Guy, Los Angeles, Cal. App. filed Sept. 10, 1919. Improved separator.

1,377,155. ELECTROPLATING BARREL; Forest H. Hartzell, Dayton, Ohio. App. filed April 22, 1919. Removable contact bars.

(Issued May 10, 1921)

1,377,194. STORAGE BATTERY; Thomas A. Edison, West Orange, N. J. App. filed June 16, 1920. For starting system of automobiles.

1,377,217. PROCESS OF RECOVERING METALLIC CONSTITUENTS FROM A MIXTURE THEREOF; George W. Mullen, Elmhurst, N. Y. App. filed Jan. 14, 1920. Separating metallic constituents from white-metal mattes.

1,377,223. AUTOMATIC FARM LIGHTING AND POWER SET; Bernhard Schilling, Paterson, N. J. App. filed Feb. 9, 1920. Storage cells supply load current except while being charged.

1,377,225. SEMI-AUTOMATIC TELEPHONE SYSTEM; Arthur J. Seymour, St. Paul, Minn. App. filed March 19, 1919. Interconnection between manual and automatic exchange.

1,377,227. SECONDARY BATTERY; Thomas Spencer, Lakewood, Ohio. App. filed July 24, 1918. Tubes of lead hold active material.

1,377,229. DYNAMO-FIELD REGULATOR; Harry L. Tanner, Brooklyn, N. Y. App. filed July 25, 1917. To vary reluctance of path of field flux.

1,377,242. NETWORK-SELECTING CIRCUIT; Charles S. Demarest, Brooklyn, N. Y. App. filed Jan. 4, 1919. Repeater circuit.

1,377,246. RAIL BOND; Joseph A. Frauenheim and Harry Etheridge, Zellanople, Pa. App. filed May 31, 1919. Of soft iron.

1,377,274. CONTROL APPARATUS; Harry F. Porter, Trenton, N. J. App. filed June 3, 1919. For recording variations of any character.

1,377,282. APPARATUS FOR MEASURING THE VACUUM IN LARGE RECTIFIERS; Bela B. Schafer, Baden, Switzerland. App. filed July 14, 1920. By passing an electric current.

1,377,325. ELECTRIC MOTOR; Charles W. Durnford, West Ealing, England. App. filed Dec. 6, 1917. Runs submerged in water.

1,377,405. AUDION CIRCUIT; Lee de Forest, New York, N. Y. App. filed April 9, 1915. For wire or wireless.

1,377,410. CIRCUIT-EXTENDING PLUG; Harry A. Douglas, Bronson, Mich. App. filed July 23, 1917. "Ediswan" type.

1,377,435. ELECTRIC FOOT WARMER; Matthys C. Rasen, Denver, Col. App. filed March 1, 1920. Remains warm after current is off.

1,377,476. CURRENT-SAVING DEVICE; William J. Hahn, Philadelphia, Pa. App. filed Jan. 20, 1920. For electric cars and trains.

1,377,477. BATTERY HAND LAMP; Carl Hambuechen, Belleville, Ill. App. filed April 13, 1917. For rough service.

1,377,492. GUARD FOR ELECTRIC HEATERS; Richard G. Ledig, Philadelphia, Pa. App. filed Oct. 31, 1919. Radiant type.

1,377,521. SIGNALING APPARATUS; Serge Oullanine, Sydenham, London, England. App. filed July 20, 1920. Selective receiver.

1,377,554. PROCESS AND APPARATUS FOR THE ELECTRICAL UTILIZATION OF MOLTEN SLAGS; Jacob E. Bloom, Brooklyn, N. Y. App. filed May 3, 1920. Manufacture of fertilizers.

1,377,555. TELEPHONE SYSTEM; Clifford C. Bradbury, Rochester, N. Y. App. filed May 16, 1910. Convertible from "call-distributing" to full automatic.

1,377,562. ELECTRIC HAMMER; Frederick W. Davey, Brooklyn, N. Y. App. filed Sept. 19, 1919. Plunger reciprocated by solenoids.

1,377,573. CIRCUIT-INTERRUPTING SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 6, 1916. Circuit breaker.

1,377,639. ELECTRIC SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed Jan. 14, 1920. Pendant switch.

1,377,645. METHOD OF MIXING BATTERY MATERIAL; Joseph W. Weiss, Madison, Wis. App. filed Nov. 14, 1918. Unusually close contact.

1,377,646. FLASHLIGHT OF BATTERY HAND LAMP; Arthur W. Wellington, Waterbury, Conn. App. filed Aug. 26, 1919. Improved switch.

1,377,722. ELECTRIC ACCUMULATOR; Guglielmo Marconi, London, England. App. filed March 9, 1918. Chlorine as active element at positive pole and zinc at negative pole.

1,377,728. LAMP FOR PROJECTING APPARATUS; Nicholas Power, Brooklyn, N. Y. App. filed Jan. 10, 1917. Motion picture.

1,377,806. WATER HEATER; Ferdinand J. Clifford, Pateros, Wash. App. filed April 20, 1920. For vaporizing water.

1,377,808. WINDING MACHINE; Frederick W. Cotterman, Dayton, Ohio. App. filed Aug. 23, 1916. For winding high-tension coils.

1,3777,822. TREATMENT OF IRON ORES; Frederic A. Eustis, Milton, Mass. App. filed April 27, 1920. Electrolytic iron direct from ore, without sintering or smelting.

New England States

HAMPTON BEACH, N. H.—The Board of Trade is considering plans for replacing the incandescent lamps now in use with ornamental lighting system.

SEARSBURG, VT.—The New England Power Company, Worcester, Mass., it is reported, is considering the purchase of a 7,250-hp. turbine and generator for its local plant.

SOMERVILLE, MASS.—The Boston Elevated Railroad Company, Boston, has acquired land adjoining its electric generating plant. The site will be used for further extensions to the power station.

WEST NEWTON, MASS.—The Security Mills, Inc., contemplates the erection of an addition to its mills and a power plant. The buildings will cost about $75,000.

NORWICH, CONN.—Plans for the installation of an ornamental lighting system, consisting of fifty lamps, on Main Street and Broadway have been approved by the Chamber of Commerce. The cost is estimated at $12,000.

Middle Atlantic States

JAMESTOWN, N. Y.—Plans are being prepared by the Crescent Tool Company, 200 Harrison Street, for the construction of a new one-story power plant. Louis T. Klauder, Pennsylvania Building, Philadelphia, is engineer.

LAUREL HILL, N. Y.—H. Hoffman, Inc., Clinton Avenue, plans to build a power house in connection with its new local factory, to cost about $60,000.

ROCHESTER, N. Y.—The Rochester Gas & Electric Company contemplates an extensive construction program, including the erection of a duplicate electric transmission line from Rochester to Canandaigua, a distance of 30 miles, to cost about $240,000.

SILVER CREEK, N. Y. — The Public Service Commission has granted the Silver Creek Electric Company permission to erect an electric transmission line to Forestville and to supply electricity for lamps and motors in that town.

ALLOWAY, N. J.—Residents of Alloway have agreed to finance the erection of a transmission line from Quinton, a distance of 3 miles.

CAPE MAY, N. J.—The Board of Utility Commissioners has authorized the Cape May Light & Power Company to issue $61,000 in bonds, the proceeds to be used for improvements, etc.

PASSAIC, N. J.—Steps have been taken by the Board of Trade for the installation of an ornamental lighting system on Main Avenue.

PERTH AMBOY, N. J.—The Board of Alderman has received a report submitted by Jay B. Franke, city electrician, covering a proposed addition to the municipal electric power plant to furnish power for the city pumping station and for additional street lamps. The cost of the improvements is estimated at $50,000.

ALLENTOWN, PA. — The Pennsylvania Power & Light Company is planning to erect an electric transmission line from the Hauto power plant in the Panther Creek Valley to Frangville.

ELIZABETHTOWN, PA.—The board of directors of Elizabethtown College has had plans prepared for the construction of a new power house at the institution. Kast & Kolker, 222 Market Street, Harrisburg, are architects.

FARRELL, PA.—The Council is having plans revised for the installation of a street-lighting system to cost about $30,000. Bids received on former plans were rejected. H. Whitford Jones, 1845 Rosaline Avenue, Cleveland, Ohio, is engineer.

HARRISBURG, PA.—Arrangements have been made by the Harrisburg Railways Company for the installation of two 600-hp. boiler units and auxiliaries at its South Cameron Street power station.

CLAYMONT, DEL. — The Wilmington Sugar Company will require considerable electrical equipment in connection with its proposed local sugar refinery, to cost about $1,000,000. The plans provide for a number of buildings including a power plant.

RICHMOND, VA.—The finance committee of the Council recommended an appropriation of $10,000 for improvements to the street-lighting in Hull Street.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

STAUNTON, VA.—Petition has been presented to the Council requesting that the municipal light plant be enlarged to supply electricity for commercial purposes.

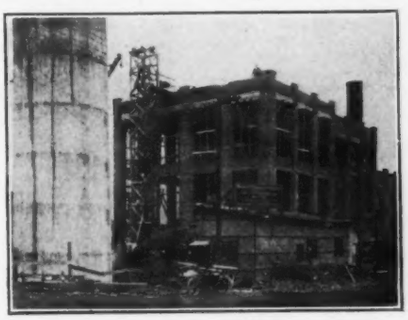
North Central States

YOUNGSTOWN, OHIO. — The Pennsylvania-Ohio Company has been instructed by the Council to prepare estimate of cost of the installation of an ornamental lighting system on four streets in the city.

BOWLING GREEN, KY.—The Kentucky Public Service Company is considering extending its lines to supply light and power to Auburn and Woodburn. The cost is estimated at about $30,000.

EAST CHICAGO, IND.—The Board of Works will receive bids until June 13 for furnishing and installing electric motors and centrifugal pumps rated at 75,000,000 gal. per day for a sewer pumping system. The total cost is estimated at $131,000.

STERLING, ILL.—The Russell, Birdsall & Ward Bolt & Nut Company is considering improvements and extensions at its plant to cost about $500,000. The proposed plans provide for the reconstruction of the present



EXTENSION OF THE CORNING GLASS WORKS UNDER CONSTRUCTION

plant, new wire mill and new power plant, including the installation of a large generator and electrical equipment. The plant will be equipped for electrical operation.

MARTINTOWN, WIS.—The Lena (Ill.) Light & Power Company is considering the construction of a hydro-electric plant on the Pecatonica River near Martintown, Wis., for which plans are being prepared. The cost is estimated at $70,000. Holland, Ackerman & Holland, 106 East Liberty Street, Ann Arbor, Mich., are engineers.

REDWOOD FALLS, MINN.—Bonds have been authorized for the installation of an ornamental lighting system to cost about $14,000.

ST. PAUL, MINN.—The installation of an ornamental lighting system on Summit Avenue, to cost about $7,000, is under consideration.

CHILHOWEE, MO.—The City Council is negotiating with the Green Light & Power Company, Pleasant Hill, for the sale of the municipal electric light and power plant. The company, it is reported, is considering connecting Blairstown, Chilhowee, Urich and Windsor.

JASPER, MO.—The City Council is considering calling an election to submit to the voters a proposal to issue $40,000 in bonds for the construction of an electric light plant and waterworks.

ST. LOUIS, MO.—The Excelsior Laundry Company, Grand and Bell Streets, contemplates the construction of a power plant to cost about $100,000, in connection with a new laundry, 100 ft. x 104 ft. B. T. Kearns is president.

MONTPELIER, N. D.—The erection of a municipal electric light plant in Montpelier is under consideration. G. W. Rulon is village clerk.

SIOUX FALLS, S. D. — The Northern States Power Company is considering erecting a transmission line from Baltic to Garretson to supply electricity in the latter town and in Sherman. It is also proposed to serve farmers along the route.

Southern States

SHELBY, N. C.—The Board of Aldermen is considering an issue of $50,000 of electric light and water extension bonds.

GREAT FALLS, S. C.—The Southern Power Company, Charlotte, N. C., it is reported, is considering plans for enlargement of its local power plant.

MILLVILLE, FLA.—Bonds to the amount of $27,000 have been authorized for the installation of electric lighting and water systems.

CHATTANOOGA, TENN. — Plans have been presented to the Commissioner of Public Utilities for the installation of an ornamental lighting system on Broad Street from Sixth to Ninth Street with a similar arrangement on connecting streets between Broad and Market Streets.

MARTIN, TENN.—Bids will be received until June 15 for improvements to the light and water plant, including the construction of a power house, installation of two alternating-current generators direct connected to non-condensing uniflow or non-releasing Corliss engines, two water-tube boilers, heater and feed pumps, switchboard, piping, chimney, elevated tank, motor-driven centrifugal pumps, resetting air compressor, street lighting material, transformers, etc. Frank L. Wilcox, Chemical Building, St. Louis, Mo., is consulting engineer.

MERIDIAN, MISS.—Bonds to the amount of $600,000 have been voted for the construction of a municipal electric light and power plant.

SAYRE, OKLA.—The town officials contemplate the construction of an electric distribution and power plant. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, are engineers.

Pacific and Mountain States

SEATTLE, WASH.—The city officials are planning to issue additional bonds to the amount of $5,500,000 for the Skagit hydro-electric project. The proceeds are to be used to carry on the work at Gorge Creek, to acquire or construct substations and to make changes to the distribution system in the city which will be made necessary for the delivery of Skagit energy. C. B. Fitzgerald is chairman of the council finance committee.

PORTLAND, ORE.—Arrangements have been made by the Portland Railway, Light & power Company for an issue of $4,500-000 in bonds, the proceeds to be used for extensions to its system and general expansion.

SALEM, ORE. — The California-Oregon Power Company, San Francisco, has applied to the state engineer for permission to appropriate 2,100 sec.ft. of water from the Klamath River for the development of 70,000 hp. near the California line in southern Klamath County.

HEMET, CAL. — Improvements to the street-lighting system are under consideration.

LOS ANGELES, CAL.—Petition has been filed with the Board of Supervisors of Los Angeles County for the establishment of a lighting district to be known as the South Gate Lighting District of Los Angeles County.

PALMDALE, CAL. — Citizens of Palmdale have petitioned the Board of Supervisors for the establishment of a lighting district which will provide for street lighting in the business and residence sections of the town.

SANTA PAULA, CAL.—Plans are under consideration by the Chamber of Commerce for improvements to the lighting system on Main Street.

Canada

GALT, ONT.—The Hydro-Electric Commission is having plans prepared for the construction of a two-story substation on Dickson Street, to cost about $50,000. A B. Scott is manager.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University of Bethlehem, Pa.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Salt Lake City, Utah, June 20-25.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting, Asbury Park, N. J., June 20-24.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City. Annual meeting, New London, June 27-30.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto. Annual meeting, Niagara Falls, Ont., June 23-25.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada. Annual meeting, Quebec, June 15-17.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Rochester, N. Y., Sept. 26-29.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa. Annual meeting, Lake Okoboji, Iowa, June 22-24.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual convention, Buffalo, N. Y., July 18-23.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITY COMMISSIONERS. Secretary, James B. Walker, Public Service Commission of the State of New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Annual meeting, San Francisco, Cal., June 14-16.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, W. J. Kreger, 47 W. 34th St., New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual convention, Duluth, Minn., June 14-16.

NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, July 12-15.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal. Annual meeting, Del Monte, Cal., June 7-9.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC RELATIONS SECTION, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. C. Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 5th Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHWESTERN GEOGRAPHIC DIVISION N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Asheville, N. C., June 15-16.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.